DOCUMENT RESUME

ED 046 227 24 EM 008 646

AUTHOR Witters, Donald R.; Kent, George W.
TITLE An Experimental Evaluation of Programming Student Behavior in Undergraduate Courses.
INSTITUTION Bridgewater Coll., Va.
SPONS AGENCY National Center for Educational Research and Development (DHEW/OE), Washington, D.C.
BUREAU NO BR-9-C-040
PUB DATE 70
GRANT OEG-3-9-560040-0057
NOTE 121p.

EDRS PRICE EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS Essay Tests, Evaluation Techniques, Feedback, Higher Education, *Independent Study, Lecture, Memorizing, Multiple Choice Tests, Programed Units, Psychology, Student Attitudes, Study Guides, Testing, *Textbook Assignments, Textbooks, Undergraduate Study, Units of Study (Subject Fields)

ABSTRACT

An examination was undertaken of a programed-study procedure employing behavior theory concepts in teaching undergraduate course material. Study units were constructed, containing a specific reading assignment and study guide questions. When the student felt himself to be ready, he was given a test. Progress through the course was contingent upon satisfactory performance. This procedure was used in 13 courses, enrolling 850 undergraduate students and taught by six faculty members over a time period of 18 months. The effects of the procedure were assessed in terms of (1) performance on hourly exams, (2) degree of participation in the program, and (3) student attitude toward programed study. The project involved (1) the refinement of programed study technique, and (2) the testing of the procedure's range of usefulness. The results of the investigation indicated that the programed-study procedure produced significantly better performance in all courses taught within the Department of Psychology and in about a third of the non-psychology courses. Student attitude was generally favorable toward the programed-study procedures. The appendices include the questionnaire used in assessing student opinion and an outline of the development of a programed course. (Author/MF)

AN EXPERIMENTAL EVALUATION OF PROGRAMMING STUDENT STUDY BEHAVIOR IN UNDERGRADUATE COURSES

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
GRANT 9-C-040

D. R. WITTERS & G. W. KENT

BRIDGEWATER COLLEGE
BRIDGEWATER, VIRGINIA
1970

AN EXPERIMENTAL EVALUATION OF PROGRAMMING STUDENT BEHAVIOR IN UNDERGRADUATE COURSES

A RESEARCH PROJECT CONDUCTED WITH FUNDS UNDER GRANT 9-C-040
DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

BY
DONALD R. WITTERS, PROJECT DIRECTOR
AND
GEORGE W. KENT

DEPARTMENT OF PSYCHOLOGY
BRIDGEWATER COLLEGE
1970

ABSTRACT

Title: An Experimental Evaluation of Programming Student Study Behavior in Undergraduate Courses.

The purpose of this research project was to examine a programmed study procedure employing behavior theory concepts in teaching undergraduate course material.

The procedure involved constructing study units containing a specific reading assignment and study guide questions. When the student felt he had mastered the material he was given a readiness test. While this test was not given a grade, he had to achieve a specified performance criterion (usually 80 percent correct) in order to progress on through the course. If he did not achieve this criterion he was allowed to restudy the unit and to take another readiness test. Progress through the course was contingent upon satisfactory performance.

The effects of such a procedure were assessed in terms of (1) performance on hourly exams, (2) degree of participation in the program, and (3) student attitude toward programmed course. The project involved (1) the refinement of programmed study technique by examining parameters suggested as relevant and (2) the testing of the procedure's range of usefulness in other course settings. Thirteen courses involving approximately 850 undergraduate students and six faculty members over an 18 month period were involved in this investigation.

The results of the investigation indicated that the programmed study procedure produced significantly better performance in all courses taught within the Department of Psychology and in about a third of non-psychology courses. Participation was highest in those courses which required the student to complete all units before gaining access to the hourly exams. Student attitude was generally favorable toward the programmed study procedures, they recognized the added mastery achieved by the new instructional technique. The programmed study technique was viewed by all involved as a valuable educational technique in the small college setting.

CONTENTS

PREFACE

This project grew out of a more informal effort by the authors to apply the instructional technique used by Keller at Arizona State University and discussed in his article, "Good Bye, Teacher", appearing in the Journal of Applied Behavioral Analysis (6).

Not reported, but herewith mentioned, are the experiences of the authors' attempt at educational research after careers in laboratory research. Two things have impressed them: (1) the difficulty in maintaining rigorous experimental control when the manipulation of experimental parameters are placed in the hands of others, and (2) details of obvious importance to the psychologist do not necessarily have high face validity to non-psychologists.

The authors wish to express their gratitude to those who have encouraged, assisted, challenged and reinforced their research efforts. First, to some 850 undergraduate students at Bridgewater College who have participated in programmed study courses. In years of lecturing we have never had such an opportunity to know so many students so well. This alone almost makes it worthwhile to give up that interesting pastime called lecturing.

A special word of appreciation must be given to col-

leagues who volunteered their courses for inclusion in this study, while maintaining their composure and good humor at our necessary interference with their courses: Professor William Barnett for his courses in Principles of Sociology, Professor Emmert Bittinger for his courses in Cultural Anthropology, Professors David Metzler and William Willoughby for their courses in Religions of the World.

Finally we wish to thank Dean Dale V. Ulrich for providing an academic setting in which research is possible, even when it runs contrary to his initial predilections, and when it leads to vocal objections from faculty colleagues and anxious students.

INTRODUCTION

This is an era of reform and change in education. After five years of widespread student dissent, the campus mood is changing from rage to reform. Most educators are in agreement that now is the time to institute new reforms, formalize experiments, and strengthen what has already been done.

Educational institutions are being challenged to improve the quality of instruction and the efficiency with which they are able to provide this instruction. A recent Carnegie Foundation report (7) has suggested reducing the amount of time required for higher education degrees. Such a suggestion behooves educators to take a close look at the quality and efficiency of their teaching.

In the past decades numerous innovations have been made with varying degrees of success in different locals. Closed circuit TV, educational TV, and now public TV (as "Sesame Street") have been used to bridge the gap between available resources and quality education for expanding numbers of students. Team teaching has been seen as a way to deal effectively with increasing numbers of students in the classroom providing an individualized educational experience for many students in a way which would not increase the demands for larger professional staffs.

In the past decade psychologists have been perfecting

the technological aspects of their discipline, and have made interesting and provocative applications of this technology in the schoolroom, clinic, hospital and prison. It should not be surprising that psychologists should turn their attention to practicing what they preach by applying their technology in the teaching of their own courses. Many psychologists committed to a behavioral technology have started applying such a technology to their own teaching. However, the number subjecting this effort to experimental scrutiny is, so far, painfully small.

Programmed Instruction vs. Programmed Study:

Educational literature is rich with references to teaching machines and programmed instruction. In programmed instruction -- whether it be the branching program of Crowder (13), or the linear program of Skinner (11), or a program for a teaching machine or a programmed text -- essentially what is done is to prepare an orderly sequence of stimulus material to be learned as dictated by the programmer's theoretical commitment. Provision is made for reinforcement by information feedback relative to the correctness of the student's response.

Perhaps the most frequently encountered problem faced by the instructor is the dirth of available programs which greatly restricts his freedom of choice as compared with the selection among standard textbooks.

In this report a procedure for use with any standard textbook will be discussed. The term PROGRAMMED STUDY is used in contradistinction to PROGRAMMED INSTRUCTION. Programmed instruction involves primarily the arrangement of stimulus materials, the presentation of such materials, and consequent feedback for reinforcement. In programmed study the emphasis in upon the management of the student's behavior when studying regular course material (such as a textbook assignment). This is done by breaking the assigned material down into "study units" from 10-30 pages, and then managing the contingencies controlling the student's progress through this set of study units. While it is possible to employ programmed text materials, regular standard textbooks have more frequently been employed. This feature permits a wide range of application and great freedom of choice among available materials by the instructor.

Programmed Study:

Pressy (10) has said that the reason his "testing and teaching" machine of the 1920's did not catch the fancy of the educator was that at that time there was no satisfactory theoretical structure to guide the preparation of stimulus materials composing the program. B. F. Skinner has since provided this theoretical structure in his concept of operant behavior, and has pioneered in the development of programmed instruction.

His attention has been directed primarily toward the programmed textbook.

The person who has exerted the greatest influence on the application of operant behavior concepts to the management of student study behavior has been Fred Keller.

Keller's Procedure:

In 1968 Keller (6) started a programmed study procedure at Arizona State University which he first used during World War II while teaching Morse code signalling to armed forces personnel. He noticed that trainees could train themselves if given appropriate feedback. He then took his method to the University of Brazil in 1965. While there, a political upheaval at that university initiated his move to Arizona State University. Here he continued to develop his new educational procedure.

One of the important appects in Keller's system was to have the student assume an active role in the educational procedure. He stated that a student would acquire much more from the educational environment if he took an active role in this process rather than a passive role in which he did nothing more than listen to materials presented by a lecturer.

A second requirement was that the student achieve a level of complete mastery in the subject matter before moving on to new material. To make it possible for all students to

do this, Keller provided a program of instruction which was graded in steps which made the probability of success very high for those students who studied the material a legitimate amount of time.

A third important aspect of his program was that of providing immediate feedback (reinforcement) for each student concerning his understanding of the material. This meant that all quizzes and tests that were administered to the student were graded immediately, allowing the student to know at what level he had performed on that particular material.

A fourth point which Keller felt important to the maintenance of student study behavior was to allow the student to pace himself in his program of study. He felt that this freedom to work rapidly when so inclined and to slack off when other demands were pressing made the educational environment much more rewarding for the student.

Finally, Keller stressed the importance of the student proctor. He felt that the advanced psychology student was capable of relating to students in the beginning psychology class in a way which provided the student with his achievement in the course. He felt that many rewards of this system were administered by these student proctors. They were able to respond in a personal way to the achievements of the students at that time when the student was making his response. They were able to engage socially in conversation in the subject

matter. They knew their students personally and made the course a much more personal experience. It seemed that these proctors were able to deliver effectively a program which might have been difficult to correctly implement without their help.

Gallup (4) initiated a programmed study program in his Introductory Psychology course at Lafayette College in 1968 which replaced the traditional lecture technique previously used. The essential features of his program were (1) the student worked at his own pace, (2) proctors were used to assist the instructor, (3) unit mastery was prerequisite for progress through the course, and (4) lectures were used for motivational purposes. Students were quizzed in a large auditorium where the proctors checked the quizzes when taken. Course information and readiness test performance were posted on a bulletin board. Final grades were significantly higher than under the lecture format. A questionnaire indicated that students worked harder, enjoyed the course more, cheated less, and were felt to be recongized as individuals. They worried about grades the same as the year before and attitudes toward the lecture were unchanged.

McMichael and Cory instituted a contingency management in their General Psychology course at C. W. Post College of Long Island University in 1969 (2). Three groups received the lecture format while an experimental group followed a Keller format. A significant difference was found between

the experimental and each of the control groups. Their questions were whether contingency management can be used to teach the subject matter of a standard text and whether or not students would learn more. They concluded that students worked harder, got better grades and enjoyed the course more.

MaLott and Svinicki (8) set up an extensive programmed study system in their Introductory Psychology course at Western Michigan University. The regular daily quiz consisted of two brief construction-type questions. Students were given immediate feedback on their performance. If the student missed either of these questions, he had the opportunity of attending one of several make-up quizzes over the reading again. The first make-up quiz was given the evening of the regular quiz and followed a 40-minute preparation period on the day's reading assignment. If the student did not answer all of these questions correctly, or did not attend the make-up quizzes, given during the remainder of the day, he came into contact with the "Doom's Day Contingency" -- the choice, either dropping the course or receiving an 'F' for the entire course depending upon the point in the semester at which this situation occurred. MaLott and Svinicki said that because the assignments were sufficiently clear and reasonable, and the opportunity to take the quizzes sufficiently frequent, it was unnecessary for any conscientious student to come into contact with the ultimate contingency, and few students did. Students

in this program worked about 12 hours a week for three hour's credit, and 80 - 90 percent earned a final grade of 'A', while less than two percent earned a final grade of 'F'.

In 1968 Ferster (3) initiated a programmed study format for his Introductory Psychology course at Georgetown University, which was similar to that employed by Keller. The unique feature is the interview used to assess student understanding. After studying a 10-15 page text assignment the student took an interview with a "listener" who had already read the unit and passed an interview. This listener used a timer and listened to the "speaker" without interruption. Both students referred to the text or notes as needed. After the speaker had finished, the listener commented on how the speaker covered the topic, mentioning important omissions, correcting missunderstandings of concepts or language. If both students were satisfied that the interview showed mastery of material, they recorded the results on a class chart, and the speaker now became the listener and found another student needing an interview. Each student was required to listen once for each time he spoke. At the end of each three to five sections (a chapter), the student took a written quiz to demonstrate his mastery. Five or six versions of the quiz were available and consisted of essay questions. If a quiz, graded by an assistant, was satisfactory, the student proceeded

to the next unit of study and interviewing. If his performance was not satisfactory, a remedial procedure was discussed with the instructor.

Johnson and Pennypacker (5) at the University of Florida used "student managers" to conduct the testing. These were students who themselves had successfully completed the course and were enrolled in an Independent Work course receiving a grade and credit for their efforts as a manager. A manager was graded primarily on the performance of his students. In the testing setting, the student was given a stack of 3 X 5 inch cards containing test items which he read aloud and answered while the manager recorded the time. The performance measure was the rate of correct responses emitted and the rate of incorrect responses emitted. Satisfactory performance was defined as no less than 3.5 items per minute answered correctly and no more than 0.4 items per minute answered incorrectly for each verbal performance on each consecutive unit of subject matter. Cumulative totals were plotted on the student's graph. Multiple form quizzes were randomly sampled from an item pool. A student was expected to complete two units per week.

All of the programmed study courses cited have several features in common:

1. Students actively interact with the course material rather than function as passive observers.

2. Progress through the course is contingent upon mas-

tery of the material.

3. Immediate feedback of their performance is provided both in terms of their perfoemance on quizzes and cumulative progress to this time.

4. The requirement of sustained effort as opposed to spasmodic effort frequent in lecture courses with infrequent examination.

5. Provision for remedial work when performance requirement is not attained.

6. Utilization of students in the capacity of proctors, interviewers, or managers.

The purpose of the present research was (1) to develop and refine the technique of management of students' study behavior, (2) to investigate procedures and parameters not a part of the early work which might come to light with increased experience, and (3) to extend the procedure of programmed study to academic areas other than the introductory course in psychology.

Specifically we are interested in comparing the effectiveness of the programmed study procedure with the traditional lecture methods in subject matter areas other than the introductory psychology course. Within the programmed study format it is desired to examine such things as the nature and function of the proctor; participating students preference and attitude data; the necessity for remediation; and contingency management procedures.

PROCEDURE

In this section a description will be given of (1) a three semester comparison of the development of the programmed study procedure in the General Psychology course and (2) a comparison of the traditional lecture format and the programmed study format in four courses -- General Psychology, Principles of Sociology, Cultural Antrhopology, and Religions of the World.

MEASURING INSTRUMENTS:

The data gathered in this study were obtained by three basic typed of instrument -- hourly exams, student performance on readiness tests, and attitude measures.

The Hourly Exam: Major hourly exams were administered from three to seven tires per course. These exams were included for four reasons: (1) they served as a means by which the performance of lecture and programmed study groups could be compared; (2) they were used to determine the student's grade for the course; (3) they provided minimal pacing for the students in the programmed study groups; (4) they imposed a minimum strain on the instructors in charge of the courses -- minimum to the extent that all hourly exams were required to be objective exams when such exams were not always routinely employed in the courses involved. All these exams were composed of from 40 to 70 multiple choice items, generally selected from the instructor's manual accompanying the textbook. Identi-

cal tests were given to both lecture and programmed sections in those cases where the method of instruction was being investigated. All tests were computer scored and item analysed. Kuder-Richardson Formula 21 reliability coefficients for all hourly exams employed were in excess of 0.70.

The Readiness Tests: This instrument was used to assess the student's mastery of the material he had studied. These tests were short, generally containing from seven to ten multiple-choice items; but in some courses had several essay type items included. Item analysis of these instruments was not made; reliability was not a major concern of the instructor who prepared the readiness tests. The instructor was more concerned with the face validity of his readiness test items. While progress through the programmed study course was based on readiness test performance, no statistical analysis was attempted on the scores of these tests.

Measures of student participation in the programmed study courses were obtained by computing percent of readiness tests taken during the semester. Records were kept of the number of test forms needed before the student passed the study unit. His score and the date he took the test were recorded. From this record the percent of work units attempted was calculated.

All exam and test data were recorded via Port-A-Punch

answer cards read directly onto a disk file of the IBM 1130 computer for later statistical analysis.

Measures of Attitude: An option survey was given to all programmed and lecture sections at the completion of the course. This 27-item survey was adapted from one used by Gallup at Lafayette College and a copy is presented in Appendix A. Students were asked to rate the characteristics described in the question on a continuum running from "much greater" to "much less" as compared to other courses which he had taken in his college work to date. All items were rated on a five point scale. Characteristics of the course to be rated were such things as the amount of pressure which the student received by the requirements of the course, the degree of mastery which he felt he was able to obtain studying the material, the degree of achievement which was developed by passing the readiness tests, the overall enjoyment which he felt was gained by being involved in the course, the degree of memorization which he engaged in in his efforts to learn the material, what influence he felt the instructor had on him in comparison with the influence that other professors had on him in other courses, what value the course seemed to put on him as an individual, to what degree the course influenced his study habits, and finally--as the course progressed--what his general feelings were toward the desirability of hearing lectures.

Osgood's Semantic Differential was used in two courses in an attempt to gain some picture as to how the students viewed the programmed study procedure in particular and educational research in general. Each concept to be assessed was evaluated on ten scales described by Osgood, shown in Appendix B. Twelve concepts were thus evaluated and related to the course, the way it was taught, how one evaluated his study in that course, and how one responded to concepts relating to educational research.

Development of the General Psychology Program:

First Semester: The students receiving the programmed study course were required to (1) complete 19 study units, (2) meet a criterion performance on at least one of three available readiness tests on each study unit, and (3) to take five hourly examinations. They also were required to complete a laboratory sequence which was not an integral part of the programmed study course and will not be discussed in this report.

1. Materials: Assigned readings from Kendler's Basic Psychology, 2d. ed. Study guides were provided with reading assignments and discussion questions covering important points in the assignment.

2. Study Units: Nineteen study units averaging 33 pages each were used.

3. Hourly Exams: Five 70-item multiple-choice hourly exams were given.

4. Readiness Tests: Three forms of a readiness test were available for each study unit. These were com-

posed of ten multiple-choice items similar to those composing the hourly exams.

5. Passing Criterion: A person could proceed to the next study unit by either of two ways: (1) passing one of the three readiness tests with eight out of ten items correct; failing form A or B held no penality other than preventing the student from going on. (2) failing all three forms of the readiness test, the student was permitted to move on to the next study unit.

6. Credit for Readiness Tests: Three points were given for each readiness test passed. These points were summed and were counted as the sixth hourly exam at the end of the semester.

7. Pacing: Readiness tests were available three periods a week. A student could take as many readiness tests as he could pass in a period. However, if he failed, he was required to restudy and return the next period. All readiness tests for a given section of the course had to be taken before the hourly exam on that section was available. This hourly exam could be taken during any regular period up to a cutoff date (the regularly scheduled date for the lecture section to be discussed in the next section). Since failure to take an hourly exam resulted in a score of zero, no students failed to meet this requirement.

8. Proctors: Four upper division psychology majors served as paid proctors. Their function was to score readiness tests as the students completed them, and to discuss the results with each student. In practice these proctors generally were able to function only in a clerical capacity because of the number of students they had to serve. There were 12 students per proctor.

9. Formal Class Meetings: There were no formal class meetings after getting the program started at the beginning of the semester.

Second Semester: During the second semester the course format remained essentially the same as during the previous semester except as noted in the discussion below. An effort was made to increase the students' motivation by manipulating a point system associated with the readiness tests. An attempt was made to examine the proctor more closely, particularly with respect to who could function as a proctor.

1. Materials: Essentially the same as in the previous semester.

2. Study Units: The number of study units increased from 19 to 34 by forming smaller units from some of the longer units of the previous semester.

3. Hourly Exams: No change.

4. Readiness Tests: Two alternate forms, A and B, were available, each composed to ten multiple-choice items. In lieu of a third form, students failing form B were required to attend a 20-minute remedial lecture covering the unit with which they had difficulty.

5. Passing Criterion: Eight out of ten items correct on forms A and B. Attendance at the remedial lecture if A and B were failed.

6. Credit for Readiness Tests: In a specific attempt to overcome a sense of frustration and failure expressed by students the previous semester who failed readiness tests, even though the test aided in getting a better grade on the hourly exam, a point system was set up as follows: form A gave five points if passed; form B gave four points if passed; and the remedial lecture gave three points if attended. These point values correspond to an A for five points, a high B for four points, and C for three points. The total number of points accumulated by mid-semester was counted as an hourly exam; accumu-

lated points during the second half of the semester were counted as a second hourly exam. Thus the readiness tests were weighted as two hourly exams, or 25 percent of the final grade.

7. Pacing: A student was required to meet the criterion on either form A, B, or attend remedial lecture before being permitted to proceed through the course. He could take the hourly exam when he had completed all the readiness tests for the section covered by the hourly exam. No date was set except that the student must complete all the work by the end of the semester. As time approached when it would become impossible for a student to complete the remaining work he was given special counseling by the instructor. Two students decided to drop the course, three managed to complete on time.

8. Proctors: Two sets of proctors were used: (1) students who had already taken the General Psychology course and (2) students who were currently enrolled in the course. These latter students had the highest grade point average in the course. All proctors were paid by the hour. The proctor-student ratio was one proctor per eight students.

9. Formal Class Meetings: None.

During this semester a change in the class environment was made. A large lecture hall was used as a study hall where students could come and read prior to taking a readiness test. Initially attendance was checked and students were lead to believe that they were expected to be there at least at the beginning of the three periods scheduled for the course each week. While the number of students using this study hall decreased as the semester progressed, it was used by a considerable number at all times. A second room was set aside in which readiness materials were handed out and collected and where the students took the readiness tests. A third room was reserved for the proctors. After reporting and taking a

readiness test, the student went to his proctor to discuss his performance. After going over his test, and discussing any problems or concepts he might wish, the proctor plotted the student's performance on his cumulative record and showed him his progress relative to his rate of test taking and the end of the semester. A copy of the recording sheet used to keep the cumulative record is shown in Appendix C. A record of his performance on the hourly exams was also kept on this form. Thus a student knew how he was performing at all times.

Remedial lectures were given by a faculty member in a fourth room. Hourly exams were taken under supervision in the same room that the readiness tests were given.

In all of the courses included in this study the same textbooks were used by both lecture and programmed study sections. Likewise the same objective hourly exams were given to both groups. T-scores were employed wherein the parameters were from the lecture section. This was done in order that the students in the lecture sections would not be put at a disadvantage gradewise by participating in this project. Final grade distributions are reported on the basis of T-scores. All statistical analyses are done on raw exam scores.

Third Semester: In the third semester a special effort was made to devise a system in which the student would develop better verbal skills in discussing the course materials. An attempt was also made to engender interest and enthusiasm for

participation in the course.

1. Materials: In addition to study guides as previously used, the discussion questions covering the text assignment were to serve as items on the readiness tests. A new text was used: Kretch, Crutchfield and Livson, Elements of Psychology, 2d. ed.

2. Study Units: No change.

3. Hourly Exams: No change.

4. Readiness Tests: Two forms composed of five multiple-choice items and two essay items randomly selected by the proctor from the study guide questions. Students answered these two questions orally. In lieu of a third form of the readiness test, the student was given a rather lengthy fill-in-the-blank exercise taken from the student workbook accompanying the text, but not otherwise used. The student took this exercise and completed it, using his textbook if nesessary, and checked his work with his proctor before leaving.

5. Passing Criterion: The student was required to get four out of five multiple-choice items correct, and both essay questions correct in order to continue with the next study unit.

6. Credit for Readiness Tests: The point system was essentially the same as in the previous semester.

7. Pacing: No change.

8. Proctors: The proctoring staff was composed of students chosen on the basis of their grade point average and were contacted following the preregistration period preceeding the semester they were to proctor. Instead of being paid, they were registered in a one-hour independent study course in the psychology department. In addition to proctoring duties, one period a week was spent with the instructor. During this period not only did they discuss course material but also how their students were performing, ways of helping them to do better, and ways to engender greater interest and enthusiasm for the course. Each proctor was assigned six students. Test data on these proctors is not included in the results.

9. Formal Class Meetings: None.

A different textbook was employed this third semester which was longer. The number of study units was increased, but the average length of assignment was decreased over the first semester. Comparing the third semester with the first there was a 79 percent increase in the number of study units to be completed; a 28 percent increase in the total amount of material to be studied; and a 37 percent decrease in the number of pages per unit.

Comparison Between Lecture and Programmed Study Procedures:

The first and third semesters of General Psychology course previously described were run in an experimental-control group design. Only the experimental groups (programmed study) were described. It was desired to compare the relative performance resulting from these two course formats. Since most of the investigations have previously employed the General Psychology course, it was decided to incorporate courses in other departments. Selection was a function of numerous considerations. Courses with large classes were desired over courses with small ones. The interest and cooperation of the instructor was a prerequisite; this eliminated some of the courses one might have liked to use. Those instructors who participated constituted popular ones in student's eyes; teachers who were willing to be innovative in their teaching. Some have a rather long history of educational innovation.

In addition to two different General Psychology courses,

courses in Educational Psychology, Cultural Anthropology, Principles of Sociology, and Religions of the World were investigated. In setting up the study units, the instructors were counseled, but ultimately they made the final decisions as to materials to be used, amount of material to be covered, size of study unit, type of readiness test, and pacing features. It was desired that this research result in a minimum of "bugging" of the non-psychology courses.

Other courses were originally included in this part of the study, but were subsequently dropped because of a breakdown of experimental control of one type or another which was discovered too late to be remedied. In one course in which different types of activites of the proctors were under investigation, half-way through the semester it was discovered that some of the proctors had simply changed their method of proctoring in order to serve their students more effectively, thereby invalidating the results. In an attempt to gather student choice data, lecture and programmed study sections were scheduled in the same courses. However, it was discovered to the horror of the authors that the instructors of these courses had scheduled the two sections at different hours. In questioning the students in these courses it became apparent that their choice of sections was influenced more by their schedule that semester. All was not in vain; the authors learned a good deal about non-laboratory research while increasing their pessimism

about permitting experimental control to get out of their own hands.

Each course was divided into two sections, one of which was taught by the lecture method and the other taught by the programmed study procedure. In all cases the students enrolled in a particular course were ranked according to their cumulative grade point average and assigned by a randomized block design to lecture or programmed sections.

In the material that follows a description of the non-psychology courses used in this study will be given, using the outline previously employed in describing the General Psychology programs. Outcome of these various procedures will be discussed under "Results".

Development of the Cultural Anthropology Program:

1. Materials: Study guides gave reading assignments only. Assigned readings were from Hoebel, Anthropology, The Study of Man, 3d. ed.

2. Study Units: Twenty-nine study units averaging 18 pages of text material.

3. Hourly Exams: All students in both programmed study and lecture sections were required to take the six hourly tests at the same hour on the date scheduled at the beginning of the course. If a student in the programmed section finished the readiness tests early he was required to wait until the announced time to take the hourly exam.

4. Readiness Tests: Two forms of readiness tests were available for each of the 29 study units. These were composed of eight multiple-choice test items. Five periods per week were set aside for taking readiness tests.

5. Passing Criterion: Six out of eight items (75 per-

cent) were required to pass readiness tests. A student was not required to take and pass all the readiness tests.

6. Credit for Readiness Tests: If students took and passed all the readiness tests in a given section of the course, he received a bonus of four points added to his hourly exam score.

7. Pacing: Hourly exams were NOT available during any readiness test period. Work had to be completed by the end of the semester.

8. Proctors: One proctor was available for ~~40~~ 27 students and served in a clerical role of passing out and collecting test materials, scoring tests as the student finished. The proctor was an upper division sociology major who would answer questions if asked. Because of having five periods a week for readinses testing, the number of students taking readiness tests at a given period was thereby substantially reduced.

9. Formal Class Meetings: Thirteen formal meetings of the entire programmed study group were held during the semester, roughly one a week.

Second Semester: In the second semester an effort was made to increase student participation by reducing the passing criterion while requiring that all readiness tests be taken.

1. Materials: No change.

2. Study Units: No change.

3. Hourly Exams: No change.

4. Readiness Tests: Two forms of each readiness test containing both multiple-choice and essay items.

5. Passing Criterion: The passing criterion was lowered from the previous six out of eight to five out of eight (63 percent). However, students were required to take all readiness tests. One could proceed onto the next study unit either (1) when he had passed one of the two forms of the readiness test, or (2) when he had passed an oral quiz given by the instructor. All units were required to be passed in order to get a grade above "D".

6. Credit for Readiness Test: No change.

7. Pacing: No change.

8. Proctors: Five proctors were provided, giving a ratio of eight students per proctor.

9. Formal Class Meetings: Eight times during the semester, generally after an hourly exam, the programmed study group met together with the instructor.

Development of the Educational Psychology Program:

1. Materials: No study guides were used. Students received an assignment sheet for the semester. Texts used were Gibson, Educational Psychology (A Programmed Text); Holland and Skinner, Analysis of Behavior (A Programmed Text); and Skinner, The Technology of Teaching.

2. Study Units: Twenty-five study units averaging 15 pages each were used.

3. Hourly Exams: Three 50-item multiple-choice exams were given.

4. Readiness Tests: Two forms of each readiness test were available. These contained eight multiple-choice and short answer items, and were available during four periods each week.

5. Passing Criterion: A score of 75 percent was required for passing. Students were not required to take and pass all readiness tests in order to progress through the course.

6. Credit for Readiness Tests: Same as for Anthropology.

7. Pacing: Hourly exams were available during any readiness test period. Work had to be completed by the end of the semester.

8. Proctors: Same as for first semester Anthropology

9. Formal Class Meetings: None.

Development of the Principles of Sociology Program:

1. Materials: No study guides were used. Students received assignment sheets at the beginning of the semester. The text was Broom and Selznek,

Sociology, 5th ed.

2. Study Units: Twenty-five study units were used, averaging 15 pages per unit.

3. Hourly Exams: Three hourly exams were given. These were part objective and part essay. Only the objective items were used in the data analysis.

4. Readiness Tests: Two forms of readiness tests were available for each of the 25 study units. These tests had eight multiple-choice items. Four testing periods a week were provided.

5. Passing Criterion: Six out of eight items (75 percent) were required to pass. A student was encouraged to take the readiness tests, but was not required to do so to continue progress through the course.

6. Credit for Readiness Tests: No extra credit was given for taking the readiness tests.

7. Pacing: Same as for first semester Anthropology.

8. Proctors: Same as for first semester Anthropology.

9. Formal Class Meetings: One meeting of the entire programmed study group per week; 15 meetings for the semester.

Development of the Religions of the World Program:

1. Materials: Study guides were provided which contained the study assignment and discussion questions to point up important aspects of the assignment. Reading assignments were in Moss, Man's Religion, 4th. ed.

2. Study Units: Thirteen study units averaging 70 pages each.

3. Hourly Exams: Seven hourly exams were given, roughly on every two study units. These were 70-item multiple-choice exams.

4. Readiness Tests: Three forms of each readiness test were available, each ten items long. Four

testing periods per week were provided.

5. Passing Criterion: Eight correct out of ten items (80 percent) were required for passing. Students were not required to take and pass all of the readiness tests in order to progress through the course.

7. Credit for Readiness Tests: Same as for Anthropology.

8. Proctors: Same as for first semester Anthropology

9. Formal Class Meetings: Seven class meetings, one after each hourly exam.

Special Investigations:

General Psychology, 4th Semester: A section of ~~101~~60 students in General Psychology was used in a 2 X 2 factorial study to examine the parameters of study unit length and active-passive proctoring. The course arrangements were essentially the same as described under General Psychology - first semester except as noted below. Students were ranked on grade point average and assigned by a randomized block design to four groups.

Groups 1 and 2 used the programmed study procedure with 39 study units. Groups 3 and 4 likewise employed the programmed study procedure but with only 13 study units, each three times as long as used by groups 1 and 2. The same materials were used by all groups. The "long" study unit group took the same readiness test questions as the "short" group, except three of the short, ten-question tests were taken at a time.

Proctoring was done by upper division students who had completed the course previously and who were paid for their services. The proctors in Groups 1 and 3 were instructed simply to handle the clerical details of passing out readiness tests and checking answers. They were to refer any questions asked to the instructor. The proctors for Groups 2 and 4 were instructed to go over each readiness test with the student as soon as he had finished taking it, having him explain his answers and giving supplementary or remedial explanations when needed. By mid-semester it became apparent that these proctors were not able to carry out their instructions; some of them in groups 1 and 3 were performing more like those in the other two groups, and vice versa. Therefore, no attempt at analysis of this variable was attempted.

Educational Psychology, second semester: A class of 64 students in Educational Psychology was used to examine study unit size. One group used short 15-page reading assignments and the other 45-page reading assighments. Students were assigned to the two groups on the basis of a randomized block design utilizing grade point average. Other characteristics of the program were like those previously described under the first semester of Educational Psychology.

~~eristics of the program were like those previously described under Educational Psychology, first semester.~~

Social Psychology: One section of the Social Psychology was used to examine the usefulness of small group discussions within a programmed study format.

The group discussion was seen as the way of adding additional rewards to the program of which it was a part. The instructor using discussion groups was running them with four basic ideals in mind through which they could make the program a more rewarding experience. First, he considered the discussion group as a novel experience within the program format. The number of discussion groups were kept at ten per semester so as not to lose this aspect of novelty. Since the general routine within a programmed class is to come to the proctor, take a quiz, talk to the proctor briefly, and leave, it was felt that some change in this overall routine would be an experience which would serve to increase the reward aspect of the total program. The second point was that in these groups the student could have a closer interaction with the professor. From the report of many students, they had indicated that to have access to the professor, whether it was used as a point of contact or not was a desirable condition. We have not checked to see if this is true for the majority of students but for those students whom we have interviewed professor contact would appear to be a rewarding experience. The third aspect

of the group discussion was that this was a time in which the concepts covered in the text would be rehearsed. The discussion engaged in by the group would involve the use of the terms and concepts which had been part of the reading assignment. In the group session, discriptions of social settings would be made using the terms and concepts employed by professionals in the field. This was done to add a degree of utility to the reading material. The fourth emphasis of the group discussion was to encourage the report of experiences which the student had which were in line with the subject matter of that particular course. The reward was the enjoyment gained in relating their experiences to others. To relate one's experience appears to be a type of communication which can be done more easily than many other kinds of verbal performance. The above four points are the basic conceptualization of the reward aspects of the group discussion experience as used in our program. The hoped for effect was that the student would become more positive in his attitude toward the overall program as well as increase their frequency of participation in the program.

Several types of activities were provided for the groups to facilitate their achievement of the desired goals. Included were variations of activity from week to week in an effort to keep the experience of the group meeting somewhat

novel. Several of the meetings revolved around interesting articles which were pertinent to the subject matter field. There were other meetings in which role play was used as a procedure by which the student could more easily use the terms and concepts employed in the text he was studying. Other sessions were devoted to relating one's experience in relation to the particular subject matter being studied. These were the three basic types of experience provided for in the group sessions. Many sessions combined two of these activities.

RESULTS

Performance on Hourly Exams:

Table 1 presents a brief descriptive summary of each course discussed in this report. Each time one of these courses is referred to in the section on Results it will be followed by a parenthetical reference to the line in Table 1 describing that course. This has been done so as to minimize possible confusion among the thirteen courses.

Table 2 shows the mean exam scores for the semester for the lecture and programmed study sections of the seven courses involved in this project. The two General Psychology courses, the Educational Psychology course, and the second semester of Cultural Anthropology showed a statistically significant difference with the programmed study sections having the higher mean score. The remaining courses failed to show any significant differences between lecture and programmed study procedures. Table 3 shows the number of hourly exams on which the programmed study section scored higher than the lecture section for these seven courses.

In the General Psychology and Educational Psychology (lines 1,3,5) courses there was a significant difference between lecture and programmed study groups on all hourly

TABLE 1

Reference Table of Thirteen Participating Classes

Ref	Course	Semester	Class Size	Unit Size	Test Periods Per Week	Student Proctor	Ready. Test Required	Lecture Section	Remarks
1	General Psychology	1	120	33	3	12:1		X	Lecture/programmed
2	General Psychology	2	60	25	3	8:1	X	X	Proctoring
3	General Psychology	3	72	15	3	6:1	X	X	
4	General Psychology	4	60	16/48	5	8:1			Unit size, proctor
5	Educational Psychology	1	100	15	4	50:1		X	
6	Educational Psychology	2	64	15/45	5	60:1			Unit Size
7	Social Psychology	1	32	18	4	32:1			Small groups
8	Cultural Anthropology	1	54	18	5	27:1		X	
9	Cultural Anthropology	2	54	18	5	8:1	X	X	
10	Principles of Sociology	1	48	15	4	24:1		X	
11	Principles of Sociology	2	38	15	4	38:1	(X)	X	Contingent Exam
12	Religions of the World	1	90	70	4	45:1		X	
13	Religions of the World	2	28	35	5	28:1		X	Choice

TABLE 2

Mean Final Grade for Lecture and Programmed Study Sections

Ref	Courses	Semester	Mean for Lecture	Mean for Programmed Study	t	df
1.	General Psychology	1	110.00	129.00	3.02**	118
3	General Psychology	3	110.38	122.77	2.13*	68
5	Educational Psychology	1	84.00	96.00	3.57**	98
8	Cultural Anthropology	1	141.48	144.03	0.28	52
9	Cultural Anthropology	2	125.00	141.00	2.21*	52
10	Principles of Sociology	1	65.92	66.03	0.05	46
12	Religions of the World	1	118.60	126.14	1.28	88

* Significant at .05 Level of Confidence
** Significant at .01 Level of Confidence

TABLE 3

An Analysis of Programmed Study Vs. Lecture Sections on Hourly Exam Performance

Ref	Course	Sem	Total No. of Exams Given	No. of Exams Programmed Mean > Lecture Mean	No. of Exams Programmed Mean Significantly > Lecture mean at .05
1	General Psychology	1	5	5	5
3	General Psychology	3	3	3	3
5	Educational Psychology	1	3	3	3
8	Cultural Anthropology	1	6	3	0
9	Cultural Anthropology	2	3	3	1
10	Principles of Sociology	1	3	2	0
12	Religions of the World	1	7	4	1

exams given during the semester as shown in Table 2. In the second semester of Cultural Anthropology (Table 1, line 9) the difference between lecture and programmed study groups became significant only at the end of the semester, and shows up in pooled scores.

Table 4 shows the percent distribution of final hourly exam averages for the three semesters of General Psychology (lines 1, 2, 3). The Kolmogorov-Smirnov two-sample, one-tailed test indicates a significant Chi-Square for differences between lecture and programmed study sections, both for the first and third semesters.

The difference in the distribution of final averages between the programmed study group of the first and third semesters is not significant.

Figure 1 shows the major exam-taking rate for the long and short study unit groups in the Educational Psychology class (Table 1, line 6). This is a cumulative plot of the mean number of exams taken on each of the 16 days preceeding the required date for the hourly exam. These data are based on the means of three such pre-exam periods.

The "short" study unit group having three times as many quizzes still arrived at the hourly exam on the average more quickly than did the group which had the longer assignments and fewer work units.

TABLE 4

Mean Hourly Exam Score Distribution for General Psychology

Ref	Semester	Section	Exam Scores 0-10	20	30	40	50	60	70	80 up	Kolmogorov-Smirnov χ^2
1	1	Programmed	3%	2	5	21	17	22	29	20	7.29*
		Lecture	0	3	15	35	22	18	7	0	
2	2	Programmed	1	0	11	14	26	22	27	11	0.412
3	3	Programmed	0	0	0	6	26	37	20	11	4.44*
		Lecture	0	3	5	22	14	33	19	3	

* Significant at .05 Level of Confidence

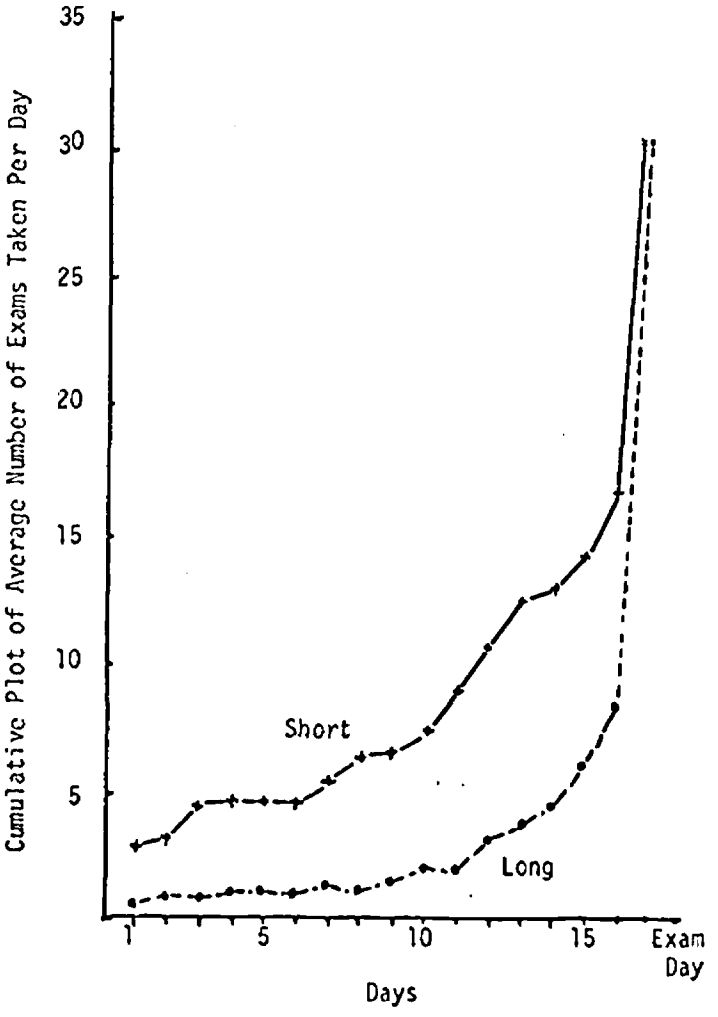


Figure 1. Cumulative mean work rate per day as a function of assignment length in Educational Psychology (line 6)

No interpretation will be attempted of the apparent FI scalloping suggested in the cumulative record for the short study unit group.

Tables 5 and 6 give the results of an analysis of variance of mean hourly exam scores for the "short" and "long" study unit groups in the Educational and General Psychology classes respectively (lines 4, 6). In both cases assignment length is significant beyond the .05 level of confidence, one-tail test. No significant interactions were observed.

Figures 2 and 3 show a plot of the mean hourly exam scores for the semester as a function of grade point level. The short study unit groups scored higher on the hourly exams at all grade point levels.

Table 7 shows the results of an analysis of the "long" and "short" study unit groups utilizing percent of readiness tests attempted by students in these two groups, and the percent actually passed of those attempted. No statistically significant differences in the means were found. An opposite effect of study length means is observed between the General and Educational Psychology courses which will be discussed later in terms of course difficulty.

Participation and Performance:

As an indication of participation in the programmed study sections, percent of students taking each of the available

TABLE 5

Analysis of Variance of Student
Performance in Educational Psychology

Source	DF	MS	F
Assignment Length	1	83.26	4.42*
GPA Level	3	235.36	
Method X Level	3	16.56	
Error	56	19.46	
Total	63		

* P<.05

TABLE 6

Analysis of Variance of Student
Performance in General Psychology

Source	DF	MS	F
Assignment Length	1	2487.94	4.38*
GPA Level	2	820.54	
Method X Level	2	39.63	
Error	24	586.31	
Total	29		

* P<.05

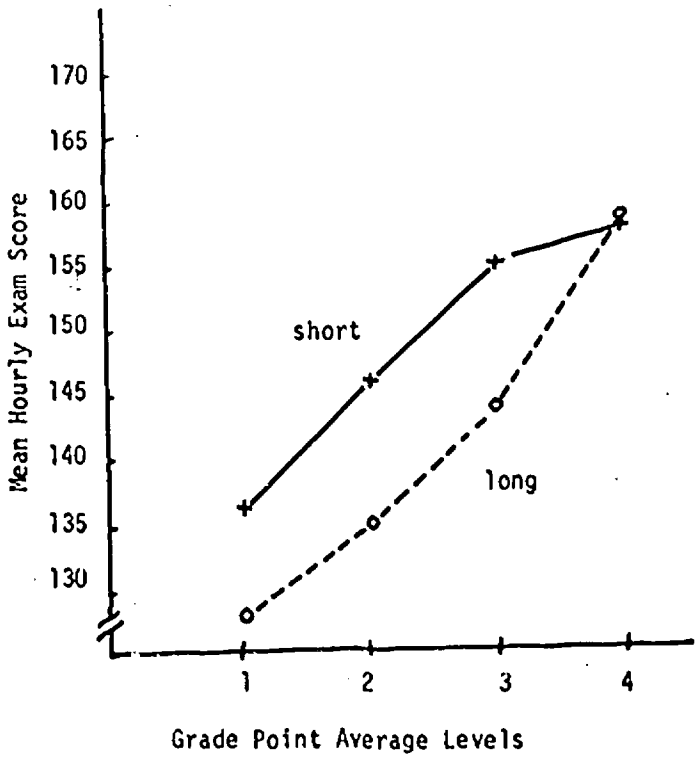


Figure 2. Mean hourly exam performance as a function of assignment length and GPA level in Educational Psychology

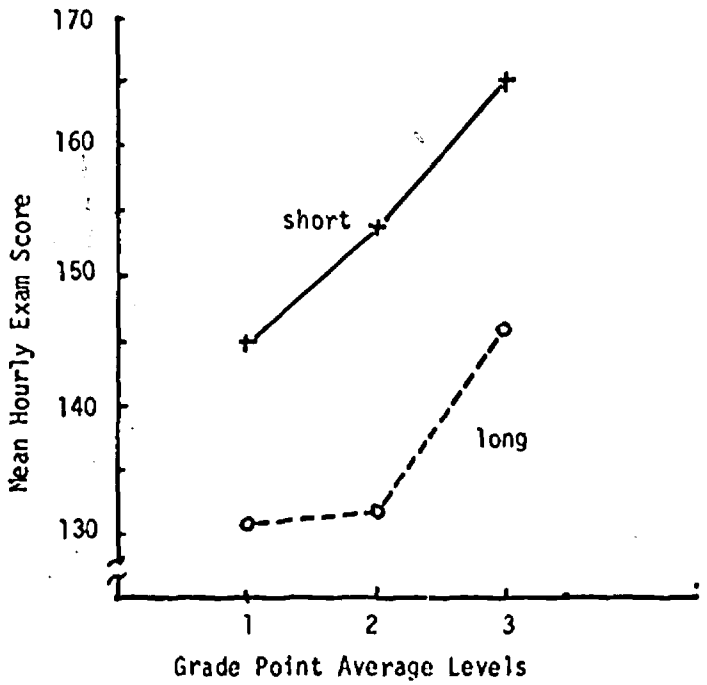


Figure 3. Mean hourly exam performance as a function of assignment length and GPA level in General Psychology.

TABLE 7

Comparison of Participation by Short and Long Study Unit Groups

Ref	Course	Measure	Short		Long		t	df
			Mean	SD	Mean	SD		
5	General Psychology	% Attempted	97.40	2.74	87.80	23.83	1.341	28
		% Passed of those Attempted	62.00	13.83	53.60	22.67	1.549	28
6	Educational Psychology	% Attempted	76.18	26.16	86.40	23.15	1.654	58
		% Passed of those Attempted	93.78	10.65	96.53	8.19	1.157	58

readiness tests was computed. This data revealed changes in participation across the semester. Table 8 presents the percent participation in the programmed sections by individual study units in eight courses having programmed study sections. Cell entries are the percent of students in that section completing the unit; the final column is a mean percent across all study units. The courses are ordered from that with the highest participation to the lowest. Table 8 also, incidentally, indicates the number of study units in each course. The third semester General Psychology (line 3) and second semester Cultural Anthropology (line 9) have the highest rate of participation.

Table 9 presents percent of readiness test passed of those taken in the programmed study sections by individual work units. Those courses whose contingencies required passing before proceeding on have been eliminated from this table. The last column contains mean percent across all study units and can be interpreted as an index of course difficulty.

A Pearson Product Moment correlation between percent passed and percent attempted across the five courses shown in Table 9 ($N = 443$) yields $r = 0.410$. At the .01 level of confidence a significant $r = 0.128$.

Figure 4 shows the relation between grade point average and percent participation, based on those sections with mini-

TABLE 8

Percent Participation in the Programmed Study Sections
by Individual Study Units in Seven Courses

Ref	Course	Study Unit Number																													Mean %
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
1	General Psychology	97	98	97	93	89	83	83	87	85	82	74	86	74	60	46	48	53	49	43											75
2	General Psychology +	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	100
3	General Psychology +	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	100
4	Educational Psychology	**	**	**	**	**	**	**	92	98	98	**	**	98	98	95	97	98	93	95	95	95	90	80	85	80					95
8	Cultural Anthropology	98	93	82	75	70	66	80	66	64	64	57	93	89	84	80	75	68	70	84	80	73	73	59	59	50	52	45	50	50	71
9	Cultural Anthropology	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	100
10	Prin. of Sociology	92	90	83	90	76	88	83	86	84	80	76	73	80	73	69	71	63	57	43											77
12	Religion of the World	52	50	50	49	50	42	47	40	39	36	33	37	34																	43

** indicates 100% of Study Units taken

+ Last five units not shown in table; percents were all 98.

TABLE 9

Percent of Readiness Tests Passed of those Attempted of Programmed Study Sections by Individual Study Units in Five Courses in Which Request to Take Readiness Tests was not Mandatory for Taking Hourly Exams

Ref	Course	Study Unit Number																													Mean %
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
1	General Psychology	86	83	77	84	88	89	64	77	71	75	83	52	60	70	67	73	61	80	81											75
5	Educational Psychology	95	93	**	98	**	**	**	**	98	**	97	95	98	**	**	97	96	**	97	97	82	**	83	**	98					97
8	Cultural Anthropology	65	76	75	82	94	69	74	79	82	89	84	78	87	32	60	67	53	35	68	74	66	56	58	46	73	57	75	73	68	67
10	Prin. of Sociology	91	95	74	80	70	93	72	95	78	82	62	**	97	78	88	69	68	46	**											81
12	Religions of the World	85	61	77	93	89	54	68	89	74	62	90	83	97																	79

** Indicates 100% of Units Attempted were Passed

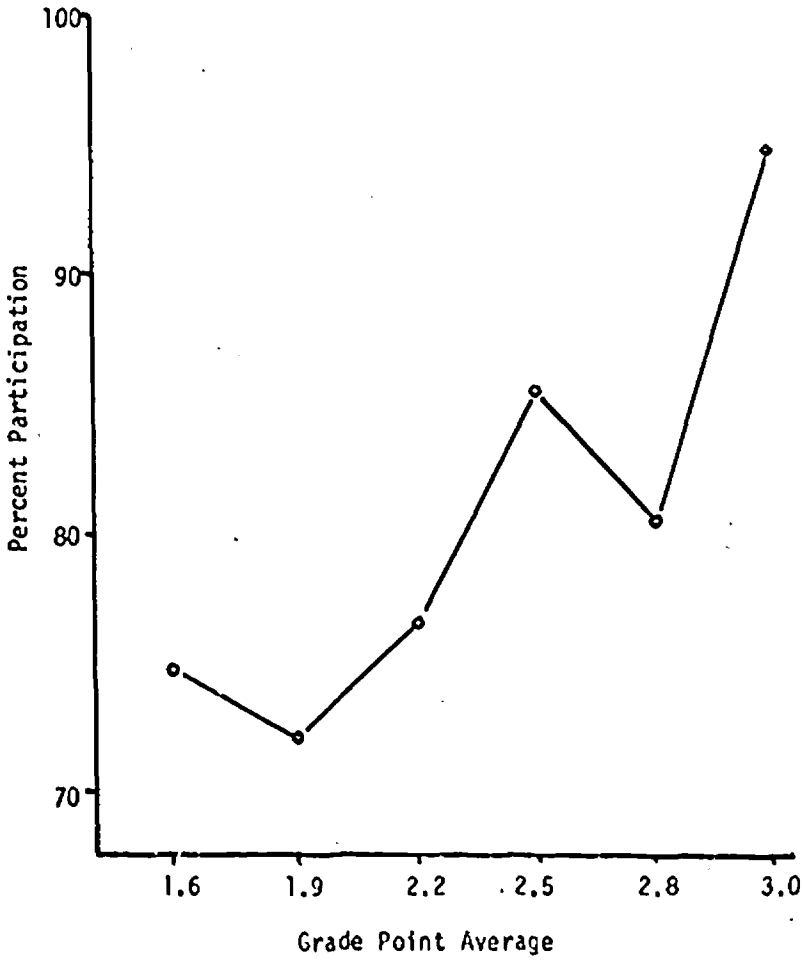


Figure 4. Percent participation as a function of GPA in sections with minimal requirement for taking readiness tests.

mal requirement for taking readiness tests. As the grade point average involved is higher, the percent of study units taken is higher. A Pearson Product Moment correlation between the percent of the study units passed and the mean hourly exam score was r = 0.167. As the .01 level of confidence a significant r = 0.128.

Figure 5 shows the percent participation as a function of study unit length for five courses which have been ordered from the one with the shortest study units to the one with the longest study units. Since these courses differ in other ways also, care must be taken in interpreting this figure.

Use of Alternate Readiness Test Forms:

The three semester sequence of the General Psychology course (lines 1, 2, 3) gives information about the utilization of the various forms of the available readiness test. Three forms were available for each of the study units. Table 10 presents the mean percentages with which forms A, B, and C were taken and passed. A fourth category, "not passed", contains failure on form C and non-attempts. The first semester of this course did not involve a rigorous requirement that all the readiness tests be taken; the second and third semesters did have this requirement for progress through the course. In all three cases a majority of the students passed on the

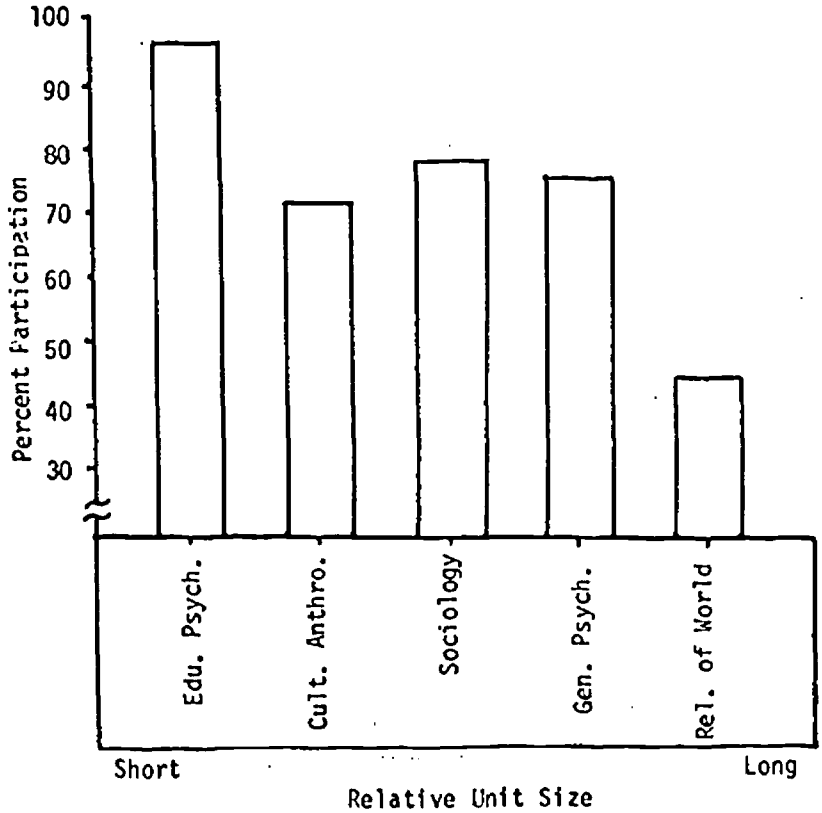


Figure 5. Graph of the percent participation as a function of study unit length in five programmed study courses in which the request to take readiness tests was not manditory for taking hourly exams.

TABLE 10

Utilization of Alternate Forms of Readiness Tests in Three Semesters of General Psychology (Mean percent passing)

Semester	N	Readiness Test Form			Not Passing
		A	B	C	
1	60	54%	3	5	30
2	60	81	15	4	0
3	35	78	14	8	0

first attempt. As passing the quizzes became contingent for progressing through the program, the percent passing form A increased. A relatively few students required the third form.

Performance and Grade Point Average:

Figures 2 and 3, previously cited, show a direct relationship between grade point average and hourly exam performance. The relationship between these variables is also shown in the results of the Cultural Anthropology courses.

In the first semester (line 8) there was no significant differences between the exam performance of the lecture and programmed study groups. In the second semester significant differences were observed. This second semester of Cultural Anthropology (line 9) is viewed as representing the best arrangement obtained in non-psychology courses, and for that reason will be discussed in more detail.

Figure 6 compares the mean hourly exam scores for the lecture and programmed study groups in each third of the grade point range for the first semester of Cultural Anthropology. Table 11 presents results of an analysis of variance of these data. No systematic difference between the two groups is indicated although overall there is a significant increase in exam performance as a function of grade point average.

Figure 7 gives the same comparison for the second semester of the Cultural Anthropology course. Table 12 presents

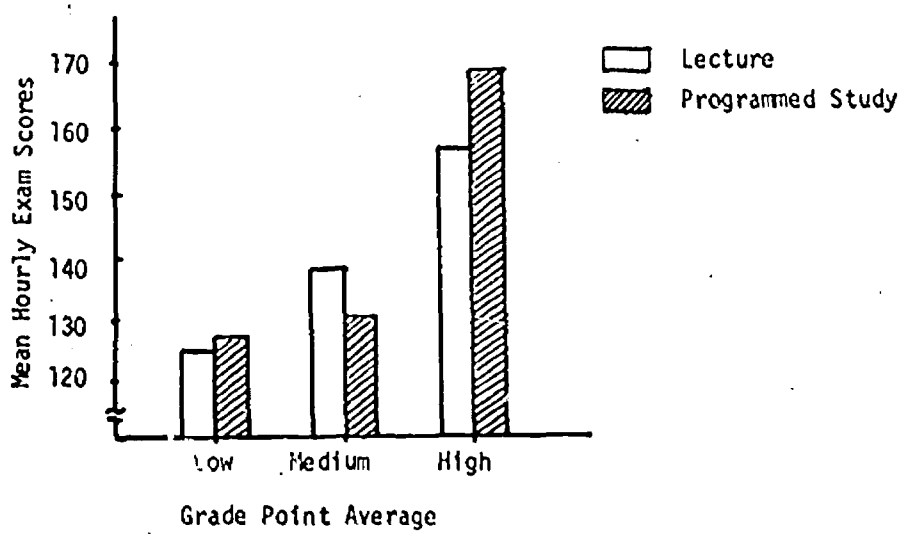


Figure 6. Comparison of Lecture and Programmed Study Sections of Cultural Anthropology, First Semester (line B)

TABLE 11

Analysis of Variance of Lecture Vs
Programmed Study Method
Cultural Anthropology, First Semester

Source	DF	MS	F
Method	1	95.09	0.11
GPA Level	2	6230.19	
Method X GPA	2	334.85	
Error	48	897.22	
Total	53		

TABLE 12

Analysis of Variance of Lecture Vs
Programmed Study Method
Cultural Anthropology, Second Semester

Source	DF	MS	F
Method	1	3400.22	4.76*
GPA Level	2	1053.01	
Method X GPA	2	713.42	
Error	48		
Total	53		

* $P < .05$

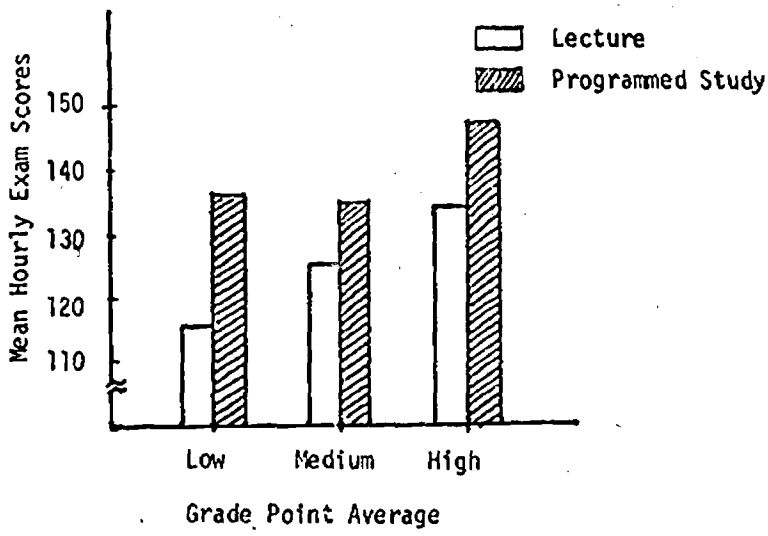


Figure 7. Comparison of Lecture and Programmed Study Sections of Cultural Anthropology, Second Semester (line 9)

results of analysis of variance of these data and shows a significant difference between methods with the programmed study group scoring higher than the lecture at all three grade point ranges.

Figure 8 makes the same comparison for the third semester of General Psychology, which has achieved the best arrangement of the programmed study format. As with the second semester of Anthropology, these data show the programmed study group scoring higher at the two lower grade point average intervals than the lecture, but not different at the highest. Table 13 presents results of the analysis of variance of these data.

In the Sociology course (line 11) students were given a choice between a lecture or programmed study sections. There was a misunderstanding of the range of application of the term "choice" and it was later discovered that those students choosing the programmed study section were given a further option of choosing whether or not to take the readiness tests. After this was discovered it was agreed that all students in the programmed study section would be required to take all of the readiness tests of the last third of the course in order to be allowed to take the hourly exam on that material. As a result we have data on the same set of students showing optional taking of readiness tests and the resulting hourly exam scores, and required taking of readiness

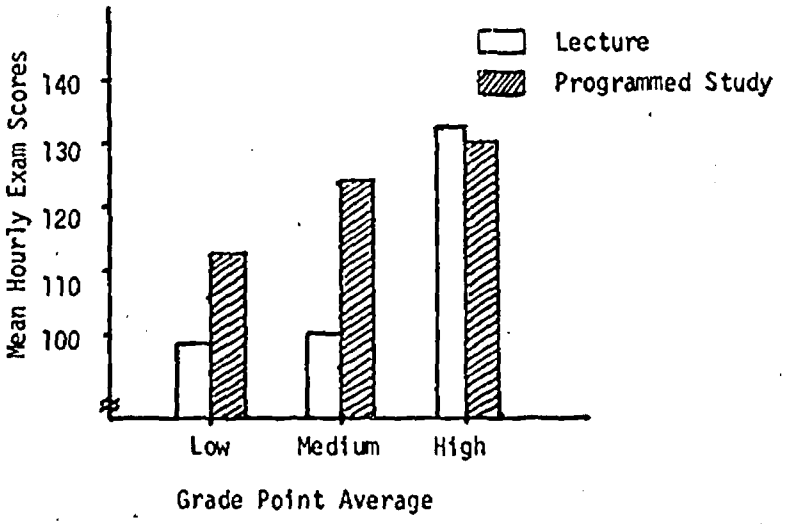


Figure 8. Comparison of Lecture and Programmed Study Sections of General Psychology, Third Semester (line 3)

TABLE 13

Analysis of Variance of Lecture Vs
Programmed Study Method
General Psychology, Third Semester

Source	DF	MS	F
Method	1	2719.53	5.72*
GPA Level	2	442.56	
Method X GPA	2	1189.76	
Error	66	475.15	
Total	71		

* $P < .05$

tests and the resulting hourly exam scores. Figure 9 shows the number of readiness tests taken by the members of the programmed study section which were associated with each of the three hourly exams. Also the scores on these three hourly exams are plotted. In the last third of the course the rate of readiness test taking greatly increased, and there was a corresponding increase in the mean hourly exam performance. Table 19 gives the results of the Analysis of Variance for repeated measures for this data. A significant difference between exams was found.

Long Term Program Effectiveness:

The first General Psychology class to be taught by the programmed study technique was retested fifteen months after they had completed the course. About one half of the students in the class responded to a request for their reevaluation. Of those responding 55% were from the programmed group and 45% were from the lecture group.

Table 14 shows the mean group performance on the fifteen months retest as well as the results of the pre- and post-standarized criteria test given these students at the beginning and the end of the course.

The criteria test results indicate that both groups increased in their ability to respond correctly to questions concerning General Psychology. The programmed group had

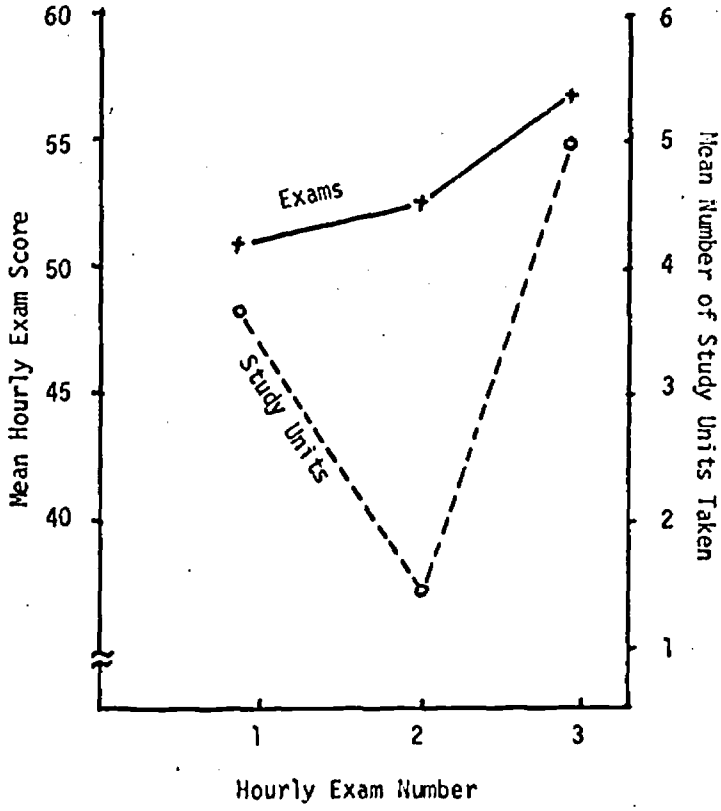


Figure 9. Mean performance on three hourly exams in Principles of Sociology compared with mean number of study units taken prior to the exam. (line 11)

TABLE 19

Analysis of Variance of Performance
on Three Hourly Exams in
Principles of Sociology

Source	DF	MS	F
Between Ss	36	232.8	
Within Ss	75	66.2	
Treatment	2	433.7	7.7*
Residual	73	56.0	
Total	111	120.7	

* P < .01

TABLE 14

Analysis of Long Term Program
Effectiveness in General Psychology

	Precriteria Text	Postcriteria Test	Exam Average	15 Month Re-exam
Lecture Group Mean	57	98	127	95
Programmed Group Mean	57	110	138	99
t value	.33	1.06	2.79*	.45

* $P < .01$

a slightly greater increase as indicated by the group mean, but this increase was not large enough to consider it a reliable difference in the group's performance brought about by the programmed study method.

The programmed study technique did have a significant effect on the students' ability to score while in the course. The fifteen month time lapse saw both groups losing about the same amount of what they had learned (25% lecture group versus 28% programmed group). The performance of the two groups after being away from the course material for fifteen months could be described as similar. The treatment had no measurable effect on their present ability to answer questions concerning General Psychology after this period of time.

Subject Matter Knowledge of Proctors:

Table 15 presents data comparing student performance of students who had proctors who had already taken the course with those who had proctors who themselves were currently enrolled in the course. These two types of proctors will be referred to as 'out-of-class' proctors and 'in-class-proctors' respectively.

No significant differences were found between mean scores on the hourly tests between students having the two kinds of proctors. Likewise, no significant differences were found in attitude toward the course and toward proctors.

TABLE 15

Comparison of "In-Class" and "Out-of-Class" Proctors on Mean Hourly Exam Scores and Item 9 of Attitude Scale (enjoyed) for General Psychology (4)

Measure	In-Class		Out-of-Class	
	Mean	SD	Mean	SD
Mean Hourly Exam Score	126.39	24.49	136.37	25.36
Mean Scale Value for Item 9 on Attitude Scale	~~6.33~~ 3.33	0.65	~~6.55~~ 3.55	0.92

Contingent Small Group Discussion:

Table 16 shows mean performance and participation data from two sections of Social Psychology using small discussion groups receiving credit for attendance at discussion sessions, and small discussion groups receiving credit for performance during the discussion sessions. Contingent performance showed higher mean hourly exam performances and higher mean percent participation in readiness tests than the contingent attendance groups.

Figure 11 shows the response of the students in the three semesters of General Psychology on eight items of the opinion survey. The students in these three semesters tend to agree that the programmed course in General Psychology is a bit more work th n they are generally used to in general education courses. They also agree that their understanding of the basic concepts presented in the course are better understood when presented in the programmed study format. The second and third semesters show increased pressure, mastery and enjoyment over the initial semester.

Student Opinion Related to the Choice of Course Section:

Attitudes observed with this pre-course survey noted some significant differences in point of view of the students in the two sections of the Sociology and Religions of the World courses. The attitudes held by those students who

TABLE 16

Mean Performance and Participation Scores
Two Groups in Social Psychology

Measure	Small Groups with Credit for Attendance	Small Groups with Credit for Performance
Mean Hourly Exam Score	54.2	59.4
Mean Percent Participation	69%	81%

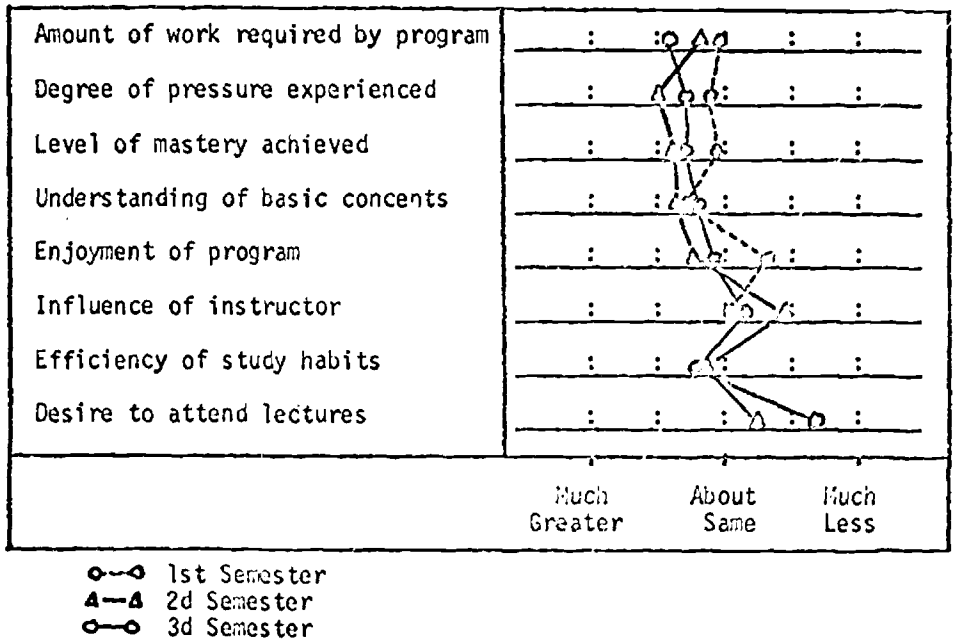


Figure 11. Summary of Student Attitudes Toward Programmed Study Courses in Three Semesters of General Psychology

registered for the programmed section of both courses were quite similar. This was also true of those who registered for the lecture course. In both courses the most striking difference in attitude was seen on the item concerning how much the student would enjoy programmed courses as compared to a lecture-type course. In both courses the lecture group felt that they would enjoy it somewhat less than a lecture course, whereas the students who had chosen the programmed section felt they would enjoy this method a bit more than a lecture course. Other differences which are similar for the programmed section versus the lecture section are in regards to their feeling about their understanding of basic concepts in the programmed course and the level of mastery of the specific units of material in the programmed course. In both cases the ones choosing the programmed course felt that their understanding and mastery would be above average as compared to a lecture course, whereas the lecture section student felt that the programmed course would produce somewhat below average understanding and mastery. On the various attitude dimensions observed those who chose the programmed section viewed it as a positive ex-

perience and those who chose the lecture section viewed the programmed section in a less favorable way. These results are shown in Figure 12 and 13.

Table 17 shows that only about half the students checked the method of instruction as the explanation for their choice of section. In the Sociology class, which was made up of 72 students, 38 of these students chose the programmed section and 34 chose the lecture section. Of these 72 students, 22 percent of them said they chose the programmed section because it was the preferred technique for them, whereas 17 percent said they chose the lecture section because it was the method of instruction which they preferred. Sixty-one percent of the students in the Sociology class made their decision as to the section they wanted on some variable other than the teaching technique. The same general trend was observed in the Religions of the World course. Of the 61 students in this class, 28 chose the programmed section and 33 chose the lecture section. Thirty-two percent of the students said they chose the programmed study technique because of its being the preferred instructional technique for them whereas 23 percent chose the lecture technique for this reason. In the course 45 percent of the students chose their particular section for some reason other than that of instructional technique.

In Figure 11 the percent of successful participation

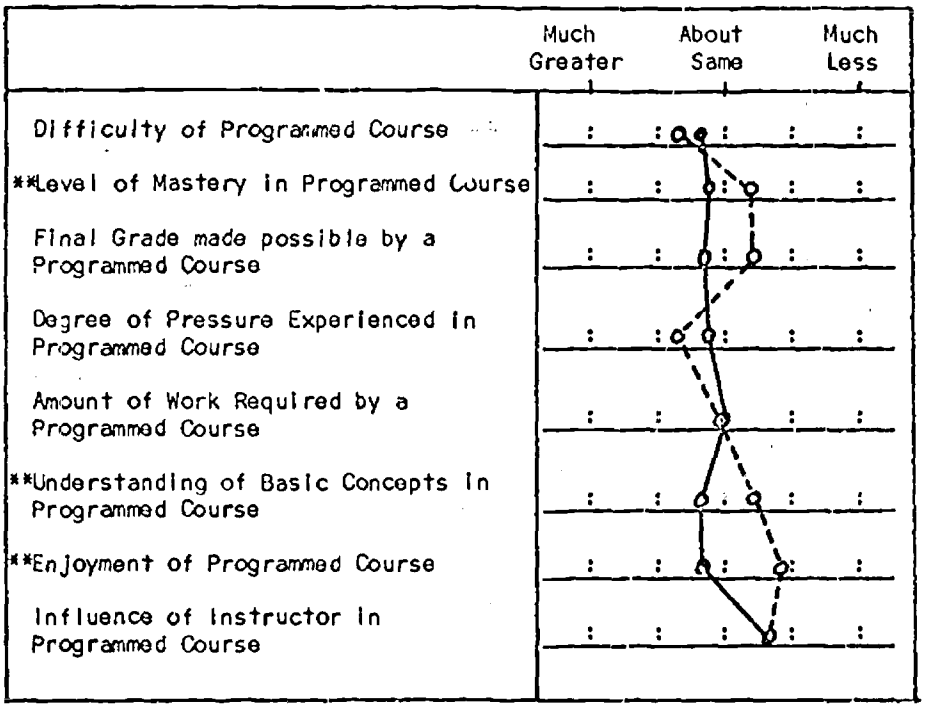


Figure 12. Pre-course Summary of Student Attitudes Toward Programmed Study Course, Principles of Sociology
●—● Programmed Section, o---o Lecture Section.
**Indicates a significant t at $P < .05$.

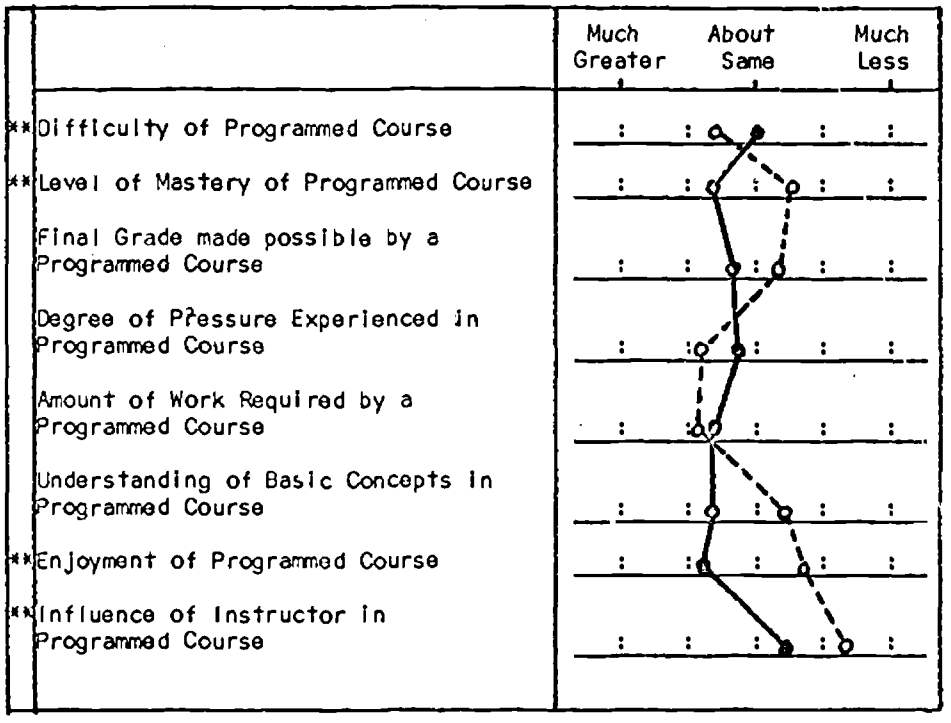


Figure 13. Pre-course Summary of Student Attitudes Toward Programmed Study Course, Religions of the World.
●—● Programmed Section, o--o Lecture Section.
**Indicates a significant t at $P < .05$.

TABLE 17

Analysis of Student Choice in two Volunteer Programmed Study Courses

Reason for Choice	Sociology	Religion
Preferred Programmed Study Procedure	22%	32
Preferred Lecture	17	23
Preferred the Time of Day	22	11
Reason not listed	39	34
Number of Students in Class	72	61

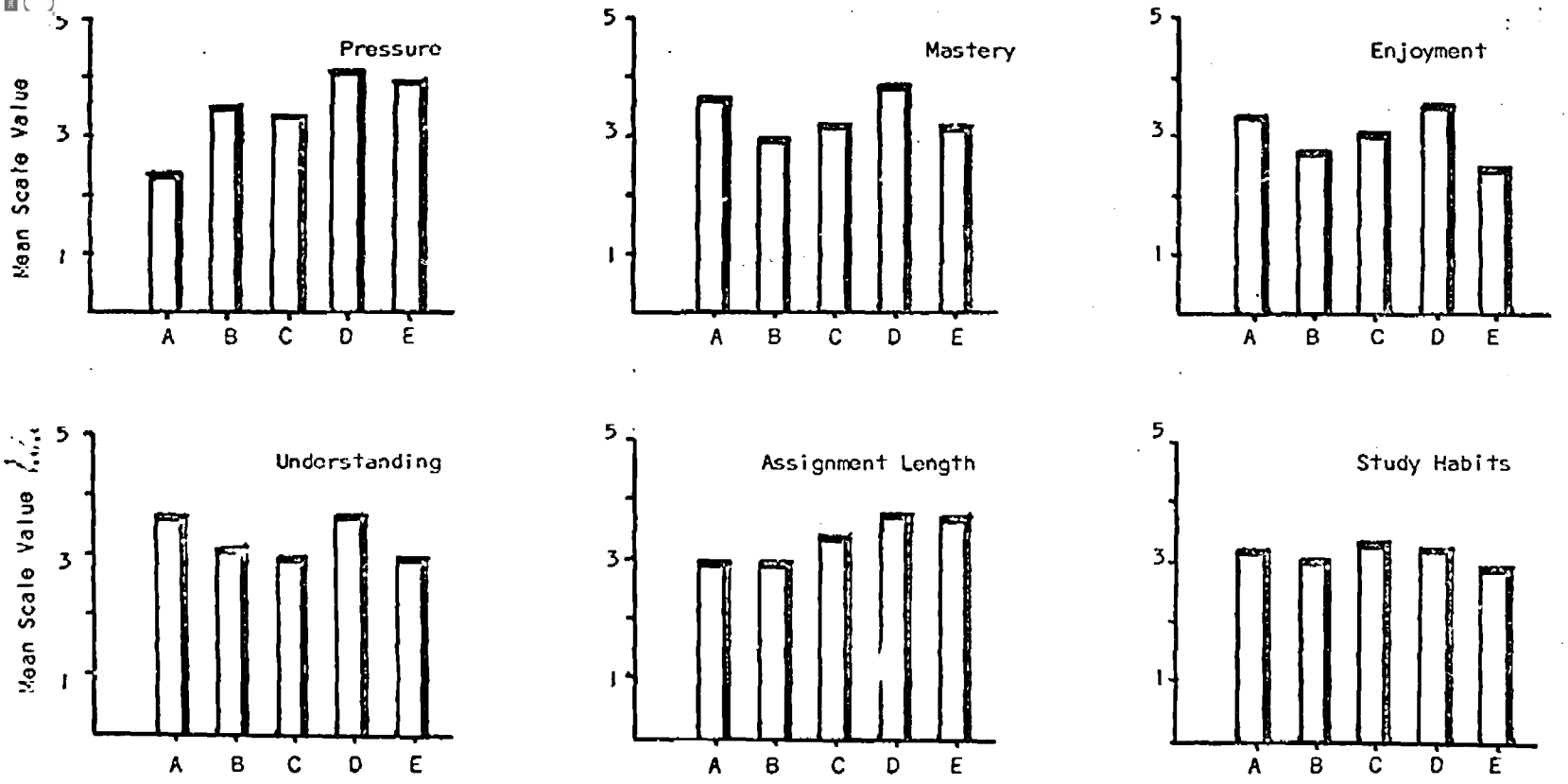


Figure 14. Student attitude on a five point scale is recorded for five courses ranked according to mean percent successful participation for the class for six attitude categories. A=Educational Psychol., B=Sociology, C=Religions of the World, D= General Psychol., E=Cultural Anthropology

is compared with regards to six attutude dimensions. These are the degree of pressure which the course seems to exert on the student, the degree of mastery which he feels was gained through the course, his overall enjoyment of the course, his feeling concerning the length of the assignment given in the course, and his feelings concerning development of study habits within the course.

The comparison in Figure 15 shows six attitude dimensions compared for two courses both of which were offered early in the program and again in the final semester. Student attitude is very similar between the earlier and later programs. In General Psychology there was a slight drop in the feeling of pressure in the course as well as in the amount of enjoyment. In Anthropology there was an increase in the feeling that they were developing better study habits and a decrease in concern over the length of the study assignment.

In figure 16 the results of the Semantic Differential Test are shown for Sociology and Anthropology. The concept of "fun" on these scales for these two classes fell somewhere between eight and nine and the concept of "evil" fell somewhere between two and three on a ten point scale. In the comparison of the response of the classes it was observed that there were five of the twelve scales in the Cultural Anthropology class in which the lecture and the programmed groups responded more favorably to the concept of Anthropology and the

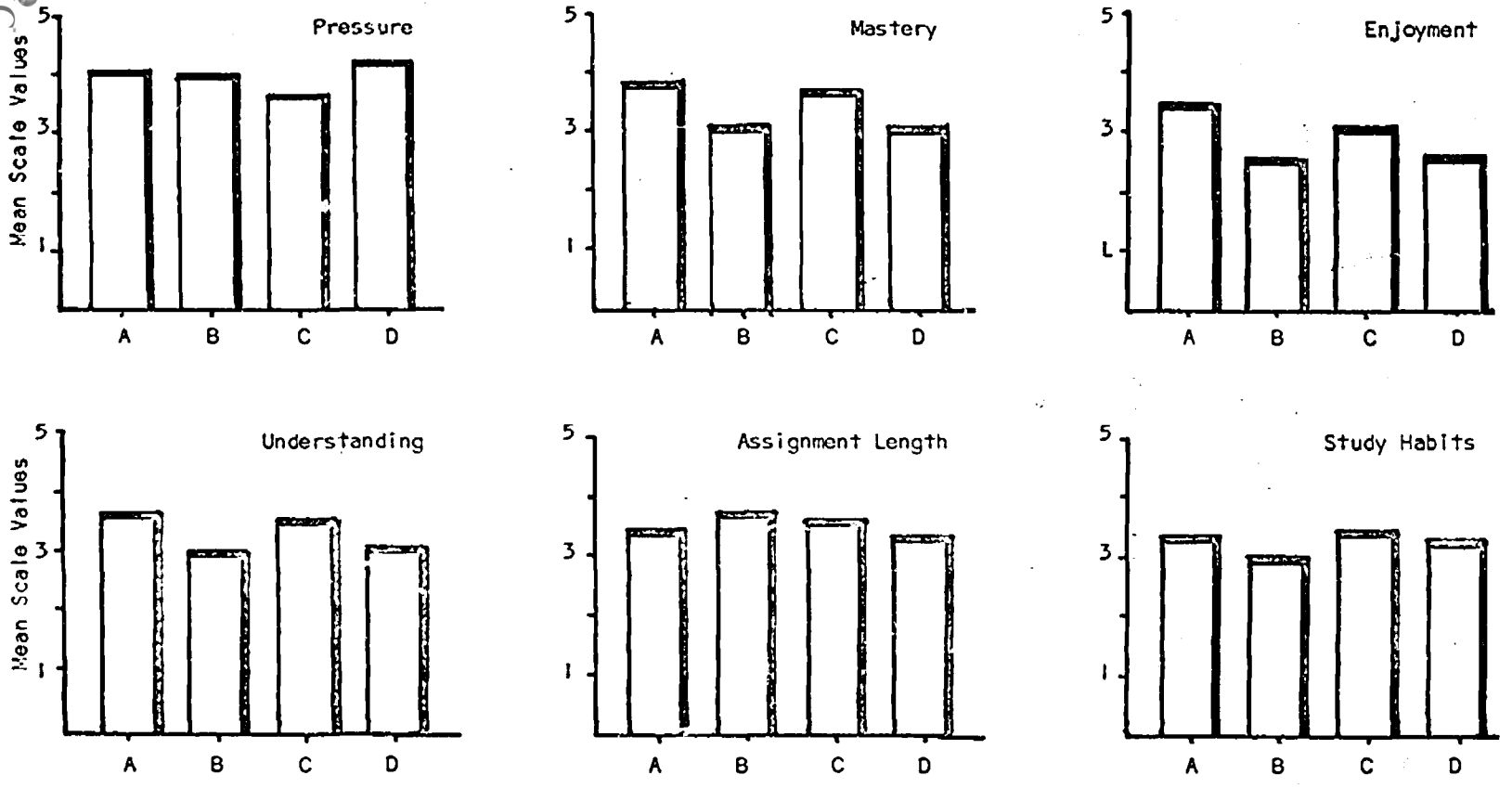


Figure 15. Student attitude on a five point scale is recorded for two courses each of which was conducted early in the program and again in the final semester of the program. A=General Psychology, B=Cultural Anthropology, C=General Psychology, 3d semester, D=Cultural Anthropology, 2d semester.

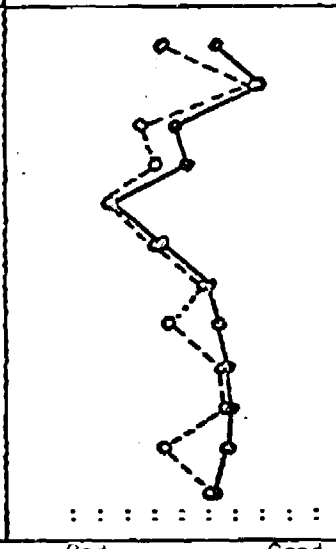
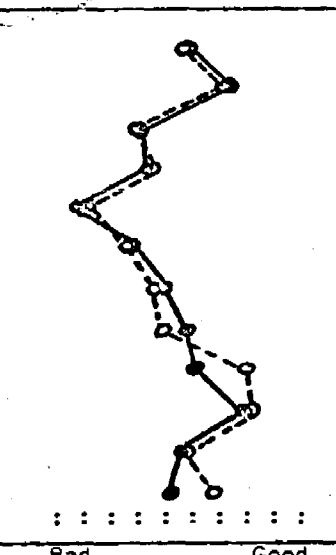
Cultural Anthropology			Principles of Sociology		
Word being Evaluated	P	Mean Scale Value	Word being Evaluated	P	Mean Scale Value
Anthropology	.02		Sociology	NS	
Fun	NS		Fun	NS	
Studying Anthropology	.02		Studying Sociology	NS	
Way course is taught	.02		Way course is Taught	NS	
Evil	NS		Evil	NS	
Lecture	NS		Lecture	NS	
Programmed Study	NS		Programmed Study	NS	
Student Proctor	.05		Student Proctor	NS	
Participating in Research	NS		Participating in Research	.05	
Dorm Life	NS		Dorm Life	NS	
Course Professor	.02		Course Professor	NS	
Educational Research	NS		Educational Research	.05	
		Bad Good			Bad Good

Figure 16. Attitudes toward words relating to Anthropology and Sociology Courses as recorded by students in the lecture and programmed study sections on the Semantic Differential. Graph shows mean scale values. ⟷ Programmed Study Section o---o Lecture Section.

concept of the way the course is taught than did the lecture group. This was true of their view of the student proctor and the course professor. All other concepts were considered to be similar for both groups. In the Sociology course only two concepts of the twelve showed any significant difference between the two groups. One of these was the view of the class members in regard to participating in research with the lecture group being somewhat more positive than the programmed group. The lecture group was also more positive than the programmed group on the concept of educational research. Student attitude towards all other concepts were considered to be similar. In both classes one can observe that lecturing is viewed as being a bit on the negative end of the scale whereas the programmed study concept is in the center of the scale.

Attitudes Toward Lecture and Programmed Study Sections:

Table 18 shows attitude data for the lecture and programmed study sections of five courses. The percent of students in each section who rated the survey item as being above average for them is included. These data are shown for eleven items of the attitude survey. From the data it can be seen that a greater percent of all the programmed study groups had more above average responses than did the lecture group on five of the survey items. More programmed study

TABLE 18

Percent of Students Rating Their Attitude

Toward the Listed Course Dimensions as

Being Above Average

Course Dimensions	3d General Psychol.		1st Cultural Anthro.		2d Cultural Anthro.		Sociology		Rel. of the World	
	Lecture	Program	Lecture	Program	Lecture	Program	Lecture	Program	Lecture	Program
Amount of Work	15	69	69	78	68	81	2	44	50	74
Amount of Pressure	15	58	56	74	65	94	9	50	45	39
Degree of Mastery	31	64	25	38	15	50	15	22	20	30
Degree of Achievemeng	38	56	35	44	56	38	32	26	35	52
Degree of Enjoyment	31	47	12	18	15	19	28	26	65	18
Degree of Understanding	62	61	29	31	26	19	40	30	35	26
Degree of Memorizing	46	75	48	60	68	69	32	52	35	79
Instructor's Influence	31	21	6	6	3	6	25	14	45	13
Worth as an Individual	2	40	2	7	3	6	25	12	25	21
Improved Study Habits	23	47	29	35	38	44	32	34	29	48
Desire to Attent Lectures	8	17	13	21	3	6	11	31	19	30

students felt that the amount of work in the course was above average. They felt that it was necessary to memorize more than they usually did in other courses. The programmed study group also indicated more often that their mastery of the material was above average. They had more frequent reports of improved study habits as well as desire to hear lectures. A vast majority of the lecture group felt that the amount of lecturing should be kept at the present level, if not reduced.

DISCUSSION

From our experience with General Psychology it is clear that certain variables are available to the teacher which allow him to increase the students' level of participation and performance. From this work it is evident that effective learning can take place in a setting in which the student is required to gain much of the information through his own skill of reading and study. Our data would suggest that as far as performance can be measured in relation to General Psychology through multiple-choice exams that those students who gain the information by their own efforts actually were able to respond correctly to a significantly larger amount of exam items. Even though students feel that more work goes into the study of the course when it is offered in a programmed fashion, they are aware that their efforts are paid off both in higher academic scores as well as the added personal satisfaction which accompanied this academic success.

From our observations of the program in General Psychology it would appear that one important aspect of the programmed study technique was that it provided a much stronger motivational structure for the student than did the traditional lecture procedure. The student was encouraged by the very nature of the program requirement to complete all units, to continue his study efforts in a systematic, day-to-day basis

if he wished to complete the course. Since the work was assigned in small units, it was possible for him to initiate study activity several times a week. This is not the usual case for a lecture course. Students report that on most occasions the assignment in a lecture course is not studied until just prior to the exam. In this case the amount of material which must be studied makes it very difficult for the student to learn it adequately. Also the actual number of hours available for study is limited. The programmed study technique seems to gain much of its power from the fact that it aids the student to schedule his study time in a more effective fashion.

The Importance of the Course Proctor:

During the three semesters of work the proctor was given an ever increasing role of importance in the General Psychology program. In each case both the proctor and the student recognized this improved significance. For example, in the first semester the proctor was little more than a clerk who scored the students' quizzes and handed out the next study assignment. The students viewed this proctor role as one which added nothing to their enjoyment of the course or to their academic success in the course.

In the second semester the proctor was more personally

identified with the student. This was done by assigning each student to a team of two proctors. Each team of proctors had about fifteen students. This allowed the student to learn to know his proctor and to have one or two persons whom he could personally identify as responsible for his progress in the course. This slight change in the proctors' roles brought a bit more recognition to them from the students. The proctors also had a slight shift in their opinion as to their contribution to the students' enjoyment and success in the course.

The third semester of General Psychology brought about the biggest shift in both the proctors view of his contribution to the course and the students' recognition of the proctor as an essential aspect of the course.

In this semester the proctor was given six students for whom he was totally responsible. He gave the student his assignment and study questions, evaluated his preparation with the quizzes made available to him, and made judgements concerning the students' understanding of the material in those cases where the students' answers were not the expected answers. If the student raised questions that the proctor could not answer, or difficult if decisions concerning the students' performance in the evaluation session were encountered, the proctor directed the student to the instructor.

In this new role the proctors had very positive feelings concerning their contribution to the course. They personally

felt that they contributed much to the students' academic success and enjoyment of the course. They felt that the students they proctored also recognized them as valuable contributors to the program.

The improvement in the program brought about by the proctors was seen most clearly in the students' attitude toward the program. Not only were the student proctors able to help the students in developing their skills in regards to the subject matter of psychology, but also their presence made the activity of quiz taking a much more desirable activity. Students and their proctors became friends. This made the quiz session less of a threat and more of a social event. In this more relaxed atmosphere discussion of the subject matter became more of a topic of interest than a topic of necessity.

The proctor who is given a role of responsibility in the program gains in two important ways for himself. First, he gains great motivation for learning the course material well, and second, he gains a sense of value and enjoyment from helping his fellow students. The investigators feel that both of these outcomes are important to the educational experience of the college student. For this reason it is felt that the position of proctor is a valuable educational experience for which the student might receive college credit.

Programmed Courses In Non-Psychology Fields:

From our data one can conclude that the programmed study technique has utility outside the field of psychology. The programs in this study were not uniformly successful outside the Psychology Department as they were inside the department. Based on our observation we felt that the lack of success in other departments was not a function of the general instructional technique, but rather a function of teaching others in the use of the technique.

All instructors understood the value of short assignment length in the program. They all provided programs which met what was thought to be an adequately short work unit except for the first semester of the Religions of the World course. The excessive length of these units was made necessary because of a lack of the needed quiz questions for the program.

Quiz preparation was carried out to the satisfaction of the authors by all instructors. The items were adequately correlated with the assigned reading material and were of a difficulty level in most cases which made passing them possible if the material had been studied.

All instructors understood the incentive value of some type of extra point system to be associated with the passing of unit quizzes. Not all of these instructors wished to use these systems. They did not wish to entice their students into taking the quizzes if they did not desire to take them.

It is felt that the type of point systems being encouraged by the investigators would not have made big improvements in the programs if all had used them. In all programs which used points but did not require passage of the units of work to move on in the program the participation gradually decreased as the semester progressed (table 3, lines 1,4,8,10,12). The points may contribute in part to the motivational aspects of the system, but are not strong enough to overcome other competing activities in which the student becomes involved.

One of the important motivational variables not clearly understood was the necessity for requiring the student to pass the study units in order to gain access to the hourly exams. In all but one program outside the Department of Psychology this requirement was not specified. The requirement most often made was that the student should take the unit quizzes, but no consequence was provided for not taking them. At worst the student did not earn the extra points which were offered for taking the quiz. The importance of this requirement can be inferred from Table 2 in which the performance of the first and second semester of Cultural Anthropology shows marked differences in favor of the group having the requirement to take and pass all work units. The change in participation for these two groups can be observed in table 3. It is felt that if the requirement of taking and passing all units was used in all programs they would have shown some overall

improvement in performance and participation.

Student Attitudes Toward The Programmed Study Method:

One of the dominant attitudes seen in our study was that the programmed study technique required more work to complete the course than did the lecture course. This work came about not because the assignments were larger but because a greater proportion of the assignment was actually completed. The definition of what constituted completion of the assignment was somewhat more stringent for the programmed study group than it was for the lecture groups. In order to do adequate work in the programmed study group, the material had to be learned well enough to answer the quiz correctly. To learn a few general concepts would not be good enough for this programmed study method, even though it may be quite adequate for the lecture section. Thus the report of more work would seem to be quite justified.

The feeling that the programmed study method put more pressure on the student was also a common response of students answering the questionnaire. The pressure seemed to be associated with the requirement of completing the assignment, that is, the student always had some work which had to be done, whereas in many of his regular courses the feeling that the work had to be done could be more easily escaped. The pressure was never identified as being uncomfortably great, but was

recognized as being present.

There was some agreement among the students in the various courses that mastery of the study matter was improved by taking the course in programmed study format. Their more active role in the learning process would partially account for this increased mastery of material.

A large number of students reported that one major advantage of the course was that they were allowed to progress at their own rate through the course. When their schedules became crowded at one period of the semester, they could slack off in the programmed course and pick it up when they had more time.

Another point of enjoyment for many students was not having to attend three lectures each week. Not all students were happy with the fact that lectures were not available, but the majority of the students were pleased that they did not have to attend regular class meetings. From the responses of the students it would appear that they sense inefficiency in the lecture procedure. Most students expressed the opinion that in the majority of lecture classes it is worthwhile to see a professor in action on some occassion, but to have this occur repeatedly becomes tiring and at many points within the lecture period becomes redundant and somewhat boring.

One of the major dissatisfactions with the programmed study method of instruction was that the students felt that it

required a great deal of memorization of material. They felt that the quizzes which accompanied the units of work asked for specific details which could only be learned through close inspection of the material and memorization of this material. They felt that this memorization of relatively unimportant material was unnecessary. It would be the observation of the authors that the same kind of memorization is required in lecture course as well. In the lecture format the student concentrates on memorizing prior to the date of the exam, whereas in the programmed study method memorization is carried on much more regularly. It would appear that the student would be better satisfied if the material to be learned was set into a more experience oriented context which would aid him in remembering material. One way to partially remedy this concern for memorization is to give more focus to the material to be learned by use of study guide questions. If the instructor makes it clear to the student that he need only learn what the instructor asks him to learn through the study guide questions, then he is not at a loss when trying to pick out the materials to be remembered. Much of the feeling concerning memorization, it would appear, arises from the fact that it is difficult to decide exactly what should be memorized.

Students in both the lecture sections and the programmed study sections indicated that the instructor personally did not influence them a great deal. From our survey it was

indicated that students in the lecture section felt like the instructor influenced them a bit more than in the programmed section but in both cases this degree of influence was much lower than one initially may have anticipated.

Additional attitude information was gained by use of the Semantic Differential. The concepts to be evaluated were 12 items which related to the course; the way it was taught, student's evaluation of his study in that course, and student's response to concepts relating to educational research. The actual headings used can be seen in Figure 6.

One might interpret that even though the programmed study technique in these two classes (Sociology 1 and Anthropology 1) had not produced significantly better performance on the part of the student, it was slightly more preferred as a teaching technique. This is a possible interpretation of items six and seven on the Semantic Differential data.

In the Sociology and Anthropology courses the same professor taught both the lecture and programmed sections. In the Sociology course the professor was evaluated on the Semantic Differential scales about the same in both classes in regards to his role as professor. In the Anthropology course this was not true, there was a significant difference in regards to how students evaluated the course professor. This difference can be associated with the different methods of teaching employed. One might generalize from this

observation that this method of instruction may enhance some professors' presentation of the material as viewed by the the students.

Comments Concerning The Assignment Length Variable:

The results of this study support the idea that task length is a relevant variable in connection with student productivity in our courses. The difference in the work pattern of the two groups was predicted from previous research data of schedule length. The difference in achievement between the two groups was more dramatic than anticipated. It is conjectured that the changed study pattern is directly related to the increased performance level. The students in the short assignment group studied more regularly and also studied less material at one time which increases the probability that much of this material would be comprehended and remembered.

Students in both courses (General Psychology 4 and Educational Psychology 2) had similar views with regards to the desirability of their assignment length and their comprehension of the material. In both courses the short assignment groups felt the assignment to be about the correct length. The long assignment groups had a distinctly different view. They indicated that the assignments were somewhat too long. This same difference in viewpoint between the long and short assignment groups was seen with regards to how well they under-

stood the basic concepts of the material. The long assignment groups indicated that they understood the material in this course about as well as they understood material in other courses. The short assignment group indicated that they understood the material somewhat better than average.

Further work is required to determine what is an optimal assignment length for a given type of material. It is our feeling that it is the overall effort invested in the task which is the important variable in this study. Task length is one dimension which increases the student's overall required effort. Task difficulty also could contribute to the amount of effort required to complete the task.

Comments Concerning The Performance-Reinforcement Relationship:

Investigators of the learning phenomenon have observed that the relationship between the activity of the student and how it changes his environment are very important. This relation has come to be called a contingency.

The effect of this performance- consequent relation has been observed both in the animal laboratory and in the classroom setting. In the animal laboratory it may mean that the rat pushes a lever which changes his environment in such a way as to make food available. His food deprived condition is relieved by the presence of additional food. In the same way, the student can answer a question in such a way as

to bring a smile upon his teacher's face. This improves the student's social environment by making it a more pleasant surrounding for him. This is also experienced by the student who upon completing his test finds that he has all of his answers correct. By means of this test taking activity the student has been able to change his environment to a more desirable state.

The teacher is in the position of establishing these contingency relationships. It is the teacher who considers the requirements which determine when the environment will change to a more desirable condition. It is the teacher who says to the student that he must get five problems correct before he can receive an "A". The nature of this contingency statement does much to control student behavior in the classroom.

An example of the influence of the educational contingency in regards to student participation is seen in the volunteer program of the Sociology class. Students during the first two-thirds of the semester were given the opportunity to take the quizzes and were encouraged to take the quizzes. As shown in Figure 4 the participation in quiz taking was very low prior to the first exam and fell drastically prior to the second exam. After the second exam the instructor required the students to take and pass the remaining quizzes in order to have access to the third exam. A contingency was established for the performance - consequent in-

teraction of quiz taking and availability of the third exam. As can be seen in Figure 9, the quiz participation prior to the third exam increased dramatically and at the same time an associated rise in exam score was observed. Performance was significantly better on the third exam than it was on the previous two exams. The educational contingency appeared to have an important influence not only on participation but also on student performance. Since the skills needed to meet the above contingency overlapped with the skills needed to perform well on the exam, exam performance indirectly benefitted by the establishment of this performance-consequent relationship.

Consideration should be given to the type of response required of the student in order to change the environment. If the teacher makes the statement that the student must take and pass all the quizzes, there may be several possible ways of responding on the part of the student which will meet this requirement. Some of these methods of responding may not be the ones which the teacher had in mind. For example the teacher may not have considered the student's copying answers off of some other student's work or the student's having access to the quiz prior to taking it. When the teacher makes the contingency statement, it is important that he know what response he desires, and accordingly set up the program to obtain this desired response.

Our program was interested in developing two types of re-

sponses. One of these responses related to the student's careful reading of the text materials assigned and the other response related to the skills of demonstrating his acquired information. The student demonstrated his acquired skills in two ways; one by a choice response to a multiple-choice question, and a second by a verbal response to a written question. It was felt by the investigators that the two general classes of responses were essential for success in the college setting as well as for satisfactory competition in the profession in which the student becomes engaged after school. Both of these responses are related to passing the quiz. The oral and choice responses to a question which are part of the quiz taking procedure are more directly related to passing the quiz, whereas the careful reading and studying of the assignment are only secondarily related to this final event of quiz passing.
In developing the contingency it is important that one consider what behaviors are required in order to accomplish the end performance. These performances which bring the student to the final consequence are the performances which the teacher wants the student to acquire. It is only after he has acquired these skills that the teacher is willing to say that the student has learned the material or skills desired.

The next step in this analysis of the contingency re-

lates to the consequence which is provided to the student for his work. There are several consequences related to the chain of events described above. Some of these are more readily measured than others. The one consequence which has been most readily measured in our study relates to quiz passing. With the quiz passing data we wished to learn more about the possible relationship existing between quiz passing and the maintenance of activities which made up the chain of behavior described above. This descriptive data consisted of the comparison of the percent of success (quizzes passed out of quizzes taken) as compared to percent participation (quizzes taken out of quizzes available). If quiz passing acted as a reinforcer, then the student who passed a high percentage of the quizzes should be more inclined to participate in the total program. The correlation of data from eight programmed courses showed a significant relationship between quiz passing and program participation. This suggests that passing quizzes possibly acted as a consequence which maintained a chain of events which terminated in this act of passing the quiz.

Quiz passing would maintain its value to the student for several reasons. First, quiz passing gave the student extra points toward his final grade. Second, students noted that

those who passed the quizzes also tended to get higher exam scores. This was most readily seen when the students were part of a course in which half of the class was being taught by a lecture procedure. Third, passing the quiz provided a sense of success in that it allowed the students to continue in the program.

Other consequences in this program which would logically seem to be effective but for which data is not collected easily would be completion of study unit. Task completion follows the activity of reading and would act as a reinforcer for reading. From common observation one finds many people saying that they feel a sense of relief or satisfaction when they have completed an assignment, thus it would be our guess that the completion of the assignment acts as a reinforcer for this activity of reading.

Another consequence which would seem to be available particularly in those sections where the proctor took a very personal interest in the student would be the social contact between the proctor and the student. This reinforcer is gained at two particular points. One would be the student arriving at the room for quiz taking. His actual activity of coming is rewarded by his meeting someone who is personally interested in him and his progress in the course. This social contact reinforcer is also given at

the point where the quiz is corrected and the student is told whether he has passed or failed. The social contact reinforcer also is available in the interaction between the proctor and student when the quiz taking is oral. This is one reason why we feel that the proctor who takes a personal interest in a small group of students provides additional social reinforcers in this educational chain of events.

One final reinforcer which students describe is that of schedule flexibility which the programmed course gave the student to arrange his schedule of activities. This reinforcer seems to be gained because the student can escape the aversiveness of having great amounts of work that must be completed at one particular time within a semester or a week. A student can avoid this work load by either doing the work ahead of time in the programmed course or delaying the work until some more opportune time. In either case the aversiveness of excessive work is escaped.

Two other aversive consequences were apparent in our programmed courses. One of these related to time needed to complete the course if several forms of the quiz were repeatedly taken. It was thought that the student would find most desirable that condition in which he had to come only one time in order to pass his quiz. For the student who came three times in order to pass a unit of work much effort was required on his part. This added effort would encourage a student to pass a quiz on the earliest form possible.

The third form of the quiz in the third semester of General Psychology was completion of filling-in-the-blank questions in the review book provided by those marketing the text. The student was required to answer all the items correctly with the aid of his book. Most students required to do it found this task mildly aversive. This is thought to be another variable which contributed to students' passing earlier quiz forms.

The Effect of Performance Evaluation Techniques:

From observation of student study behavior during this year and one-half of investigation of programmed study, it became clear that how one evaluated the student's work makes a difference in the way the work is done. Our observation was basically through student report and instructor's questioning of students as to their preparation techniques. From these informal inquiries several hypotheses were raised regarding the role of evaluation in an instructional program. At least two roles of evaluation became evident as one considered this problem. Evaluation generally is directly related to the process of assigning a grade to students' work. This role evaluation required that the measuring instrument be reliable. When evaluated the student was accurately placed on a scale which compared him to other students who also took this class.

Another role of evaluation particularly associated with

the programmed approach of instruction views evaluation as leading to a consequence for the student's performance. Evaluation as a consequence is also concerned with reliability of measurement, but not in the same way as those who use evaluation as the major way of assigning grades. As a consequence, the instructor is interested only in differentiating those who have performed to the minimal standard from those who have not done so. The instrument must reliably differentiate this point but need not differentiate between possibly the hundred different points of a percentage continuum. To gain reliability in the second pass/not pass situation is a somewhat easier task.

In using evaluation as a consequence the instructor still finds that the student's work must be assigned a grade. This grade may be designated by pass/not pass or it may be designated by some letter or number designation. This grade has usually been arrived at in the programmed study format by assigning some value to each of the work units completed thus having the grade determined by the total number of units completed. The programmed study procedure emphasizes success. It emphasizes repetition of material until minimal standards are achieved and assigns a high grade to all who complete the required work.

This method of evaluation effects some students in the class differently than others. Students who ordinarily under traditional method of grading had received "A"'s will still

be able to achieve "A"'s with the same relative ease they have always achieved "A"'s. Under the procedure where a particular minimum performance is required, the "B" student will also be able to make an "A" with relative ease. Students who are most dramatically effected by this procedure are those who fall in the low "C" range or possibly the "D" range. These students on previous occasion could receive credit for courses without completing much quality work. Many of these students, from our observation, are not students who study regularly. For these students life is made somewhat more difficult. Credit for the course is not available for this minimum amount of work. For them to receive a low grade a great deal of work is demanded. The programmed course requires the student to pass a percentage of the units to get credit for the course. Thus the person who wants to just "sneak through" the course is trapped into the situation of putting out just a little more work and receiving a decent grade for the course. Some of these students appear to be happy that they are put into this situation, others find it an infringement upon their rights if not allowed to be unproductive.

The program initially started with all multiple-choice tests. This testing form was chosen because large numbers of questions were needed to carry out the evaluation necessary. Many texts being used had available pools of these questions which could be used for quizzing. Multiple-choice tests also seemed

desirable because they could be graded easily and the student could have immediate feedback on his quiz performance. As time went on, it became obvious that many disadvantages of the multiple-choice test could be overcome by some other form of testing. One basic disadvantage discovered was that students searched through the material to find those items which would most easily lend themselves to multiple-choice questions. Thus their study behavior became one of finding possible test items rather than gaining a more integrated view of the concepts being discussed in the text.

From our observation of the programming procedure it becomes apparent that the technique of evaluation does much more than just assign a grade to the student's performance. It is obvious that the student's performance is not as independent from the instructional system of which he is a part as previously had been thought. The student's ability and his motivational level are in part determined by the educational system itself. Evaluation becomes one of the major motivating influences in the programmed study procedure.

In our evaluation procedures we have shifted from completely multiple-choice quizzes to a combination quiz composed of both multiple-choice and essay question. The essay questions added as part of the quiz were taken from the study guide questions. The essay questions were added to the quiz for two reasons (1) they encouraged the stu-

dent to study the material in such a way as to comprehend the general concepts and be able to express them in a clear and concise manner, and (2) they aided the student by giving him a specific focal point for his study. The number of essay questions provided as part of the study guide were six to ten and the number of the questions asked on the quiz were two. Having the questions ahead of time allowed the student to focus his attention on particular concepts rather than having him search for those items which might be important. The program is more interested in developing the skills involved with comprehending the material than developing the skills of searching through the text to find those concepts which the instructor designate as important.

From our work we were pleased with the essay exams, they added a great deal to the effectiveness of the quizzing procedure and gave direction to the study behavior of the student. On many occassions these essay questions became the central item for discussion between the proctor and the student. As part of the quizzing procedure the student was often asked to elaborate his answer on his essay question as a means to encourage more interaction between the student and the proctor regarding the subject matter.

Jack Michael, who has used self-study techniques for several years, has used only essay exams. From Michael's experience, he feels that extensive use of the essay exams im-

proves the student's study procedure as well as the student's ability to express himself in relationship to the subject matter. Michael's technique is to provide extensive study guides directing the student's attention to all the concepts which he is interested in having them learn. This allows a student to give his full attention to the actual learning of the concepts rather than searching for and sorting out those concepts which might be important to the instructor. If the available manpower can be located to grade these exams it appears that essay exams are a preferable technique in that they develop the skills which are considered valuable and important in the college setting, skills such as: (1) comprehension of concepts, gained by studying the material, and (2) self-expression, displayed in feeding back the concept learned.

Public Acceptance of the Programmed Study Method:

The college administration, though initially concerned about student reaction to the new method of instruction, was willing to go along with the programmed study procedure for a semester's Pilot Study. They were sensitive to any complaints which students made concerning the method. These complaints were few, but frequent enough to keep the administration inquisitive about student acceptance of the project. After the first semester the administration allowed

the experimenters to plan an expanded research program and to apply for funds in support of the proposed research. After the programmed method was used for two semesters, the administration was fairly confident that the program could contribute to the educational experience of the students thereafter supported our efforts without reservation.

Faculty members on the college staff had various reactions to this new method of instruction. Some showed interest in the method and were willing to try the procedure in their own classes. Other members of the faculty were concerned that the new teaching procedure required so much student time in preparation that the students were not able to do adequately their work in other classes. The majority of the faculty members had no strong opinion about the programmed study procedure.

The initial student reaction was one of curious skepticism. They were interested in a new approach to instruction. They especially liked the fact that Bridgewater College was trying something new, but they were not sure they liked the new role of the teacher. The students felt that the instructor was not doing his job if he was not lecturing.

Student opinion polorized at the end of the first year during which the programmed study method was used. The student newspaper carried articles which reflected dissatisfaction with the programmed study method. The following quotes

are taken from the student newspaper:

----"there is not enough time to take the readiness quizzes."

----"there is so much cheating going on that it's really of no benefit to very many people."

----"is anyone getting his money's worth?"

----"has anyone seen his prof. lately?"

----"have your student-professor relations improved?"

----"if one wanted this type of education all one would have to do is send away for a guide and the only expense would be postage and a match pak?"

Other articles by students defended the procedure. These students felt that the instructional method was a step forward in teaching technology.

----"B.C. seems to have reversed their conservative trend, and really giving the students a chance to 'do their own thing'."

----"many (students) thought it (programmed course) was a good idea in the fact that they didn't have to sit in class and listen to boring lectures."

----"another plus for the new system is that the student can pace himself and adjust his studying schedule around other pressing matters "

By the beginning of the second year of the project students had come to publically voice acceptance of the

procedure. At present the technique is no longer a topic of concern. Many students react positively toward the method and wish to be part of courses which use the new instructional method.

APPENDIX A

QUESTIONNAIRE FOR ASSESSING STUDENT OPINION

We are interested in knowing how you feel about several aspects of this course which you are now completing. Our desire is to provide courses which are interesting, stimulating, and viewed as valuable by you. Part of this interest and stimulation is provided by the techniq of teaching employed. Your honest opinions are needed so that we may refine our procedures and materials.

Please punch the appropriate letter (a, b, c, d, or e) before you choice of the alternatives presented.
Please punch your student number and card no. "1".

Thank you

1. omit

2. omit

3. You are taking the opinion survey in which course?

   A. General Psychology
   B. Educational Psychology
   C. Sociology 20
   D. Religions of the World
   E. Social Psychology

4. What teaching method is being used in this class?

   A. lecture procedure
   B. programmed procedure

5. In comparison with other courses, I think that the amount of work required by this course is:

   A. much greater
   B. greater
   C. about the same
   D. less
   E. much less

6. In comparison with other courses, the degree of pressure on me to the work of this course was:

   A. much greater
   B. greater
   C. about the same
   D. less
   E. much less

7. In comparison with other courses, the percentage of my mastery of the assignments in this course was:

   A. much greater
   B. greater
   C. about the same
   D. less
   E. much less

8. In comparison with other courses, the feeling of achievement generated by passing tests in this one was:

   A. much greater
   B. greater
   C. about the same
   D. less
   E. much less

9. In comparison with other courses generally, my enjoyment of this one was:

   A. much greater
   B. greater
   C. about the same
   D. less
   E. much less

10. In comparison with other courses generally, the likelihood of cheating was:

    A. much greater
    B. greater
    C. about the same
    D. less
    E. much less

11. In comparison with other courses generally, the temptation to cheat was:

    A. much greater
    B. greater
    C. about the same
    D. less
    E. much less

12. In comparison with other courses generally, my understanding of basi concepts and principles in this course was:

    A. much greater
    B. greater
    C. about the same
    D. less
    E. much less

13. In comparison with other courses generally, my tendency to memorize details in this course was:

    A. much greater
    B. greater
    C. about the same
    D. less
    E. much less

14. In comparison with other courses generally, the influence of the instructor on me in this course was:

A. much greater
B. greater
C. about the same
D. less
E. much less

15. In comparison with other courses generally, the recognition of me as an individual in this course was:

A. much greater
B. greater
C. about the same
D. less
E. much less

16. As the term went on, I found that my study habits in this course were:

A. greatly improved
B. improved
C. unaffected
D. harmed
E. greatly harmed

17. As the term went on, confidence in my ability to master the study assignments:

A. increased greatly
B. increased
C. was unchanged
D. decreased
E. decreased greatly

18. The size of the study assignments in this course was:

A. much too great
B. too great
C. about right
D. too small
E. much too small

19. As the term went on, my worry about my final standing in the course:

A. increased greatly
B. increased
C. remained about the same
D. decreased
E. decreased greatly

20. As the term went on, my desire to hear lectures:

A. became much greater
B. became greater
C. remained about the same
D. became less
E. became much less

21. Of your total study time per week, approximately what percentage of this time do you devote to studying material in this course?

A. 0-15%
B. 15-30%
C. 30-45%
D. 45-60%
E. more than 60% of the total study time

22. Where do you study?

A. my own room
B. dorm study room
C. "Eyrie"
D. library
E. other

23. Under what conditions do you study?
A. in silence
B. usually with a record player, or radio
C. other

24. Do you frequently study the course material with some one else?

A. no
B. yes, with 1 other person
C. yes, with 2 other persons
D. yes, with 3 other persons
E. yes, with 4 other persons

25. Would you recommend the subject matter of the course to any of your good friends?

A. definitely not
B. maybe
C. probably
D. yes
E. no opinion

26. Which one of the following procedures was most valuable to you in preparing for exams?

A. unit study guide
B. syllabus & course outline
D. group discussion
E. study hall-quiz period

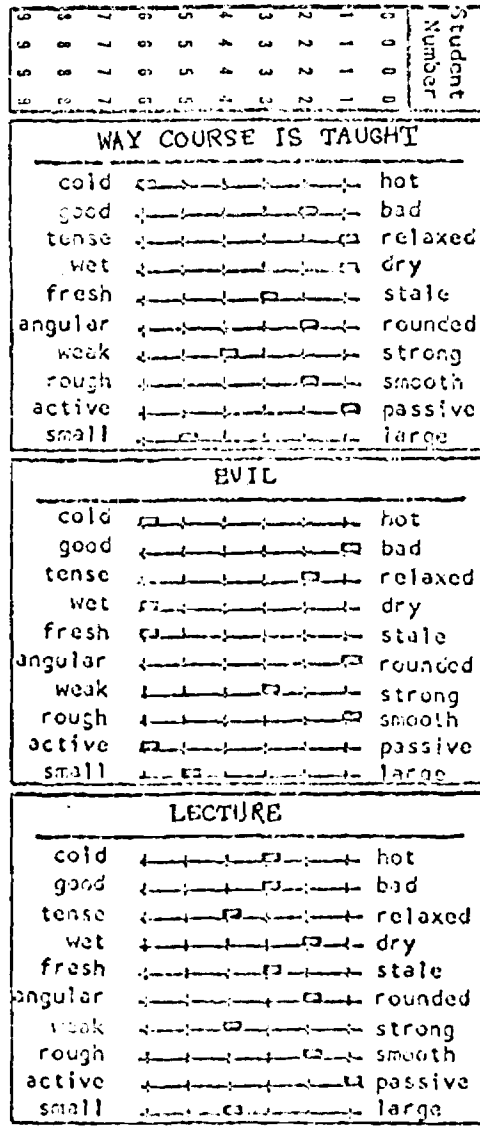
27. What was the most interesting aspect of this class?

A. textbook
B. outside reading
C. lectures
D. small group discussions
E. other (lab observation, etc.)

APPENDIX B

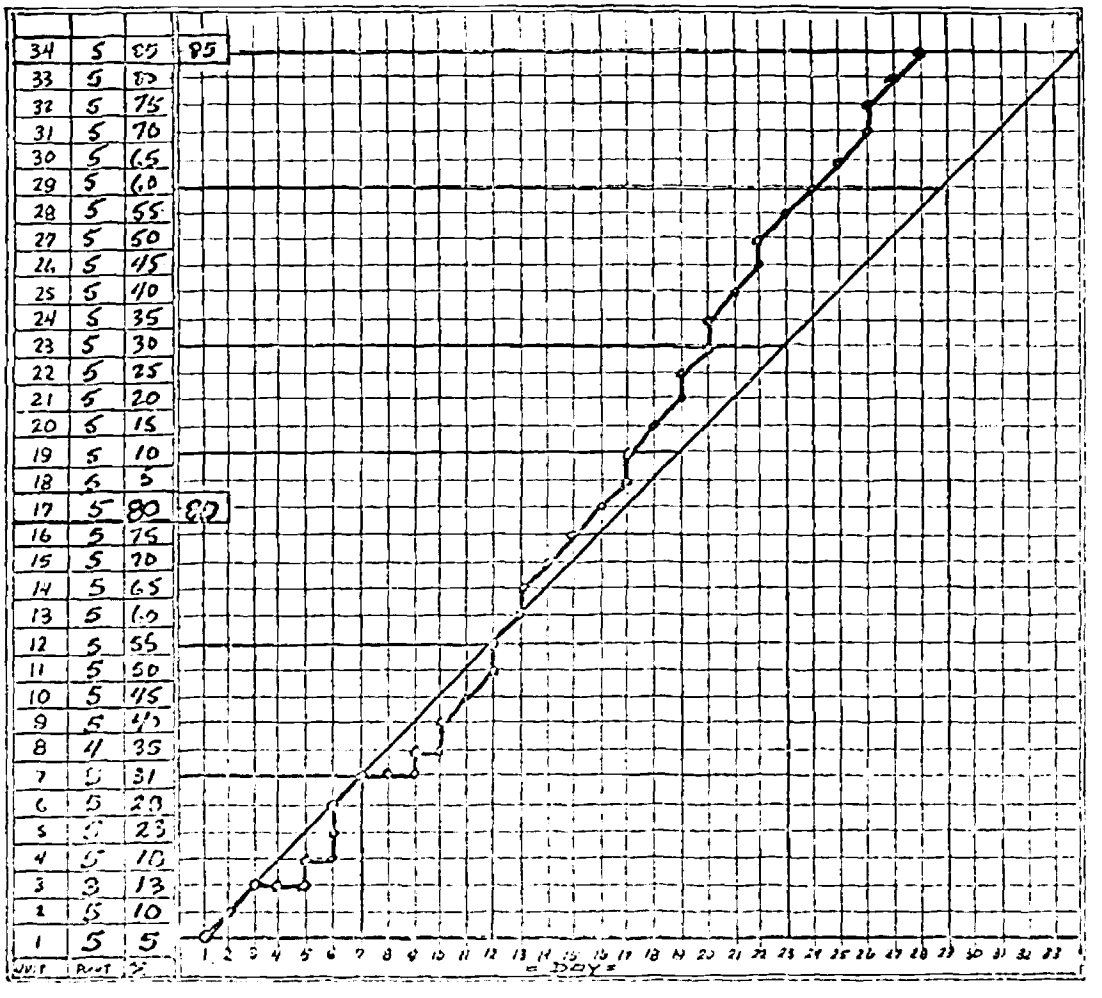
SEMANTIC DIFFERENTIAL TESTING INSTRUMENT

The Semantic Differential test was administered with four IBM Port-A-Punch cards as shown below. Each card contained three concepts to be evaluated on the ten scales shown on the card.

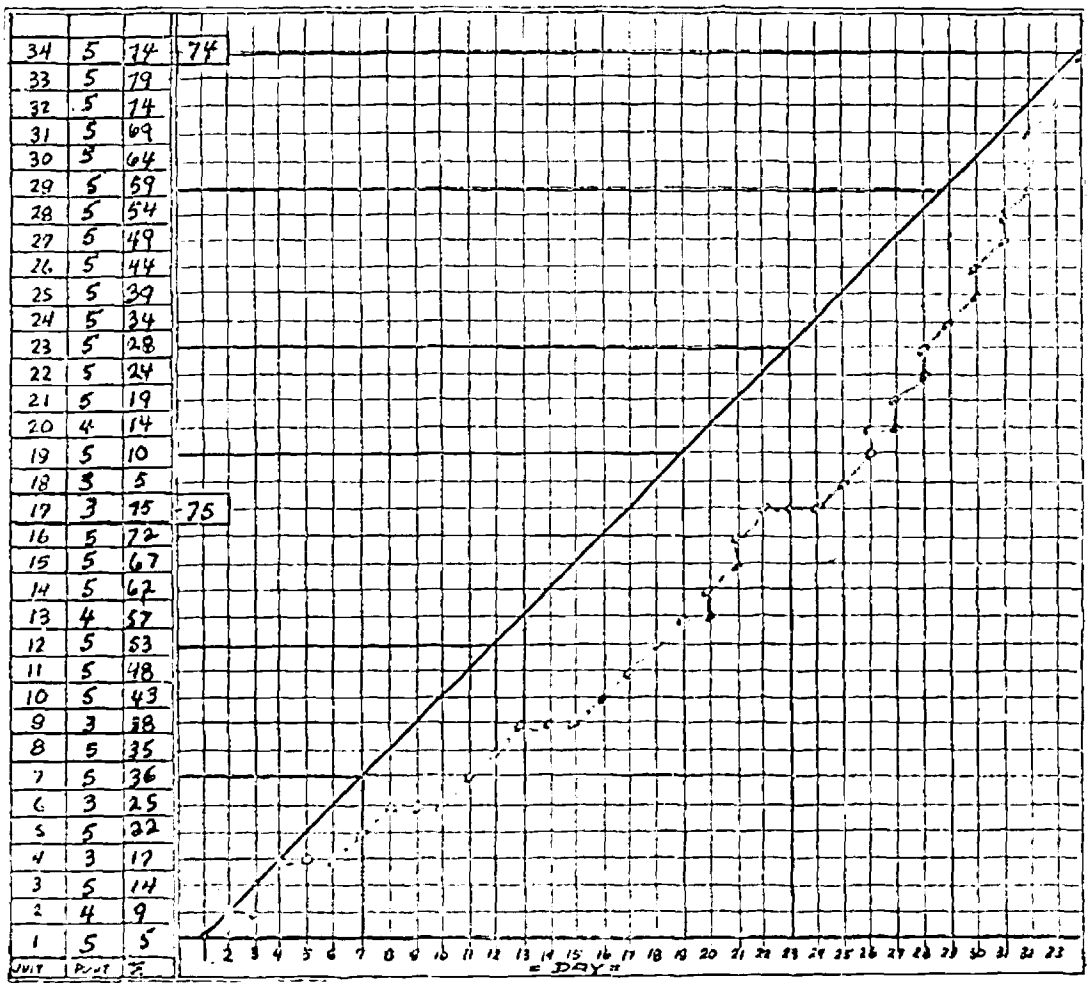


APPENDIX C

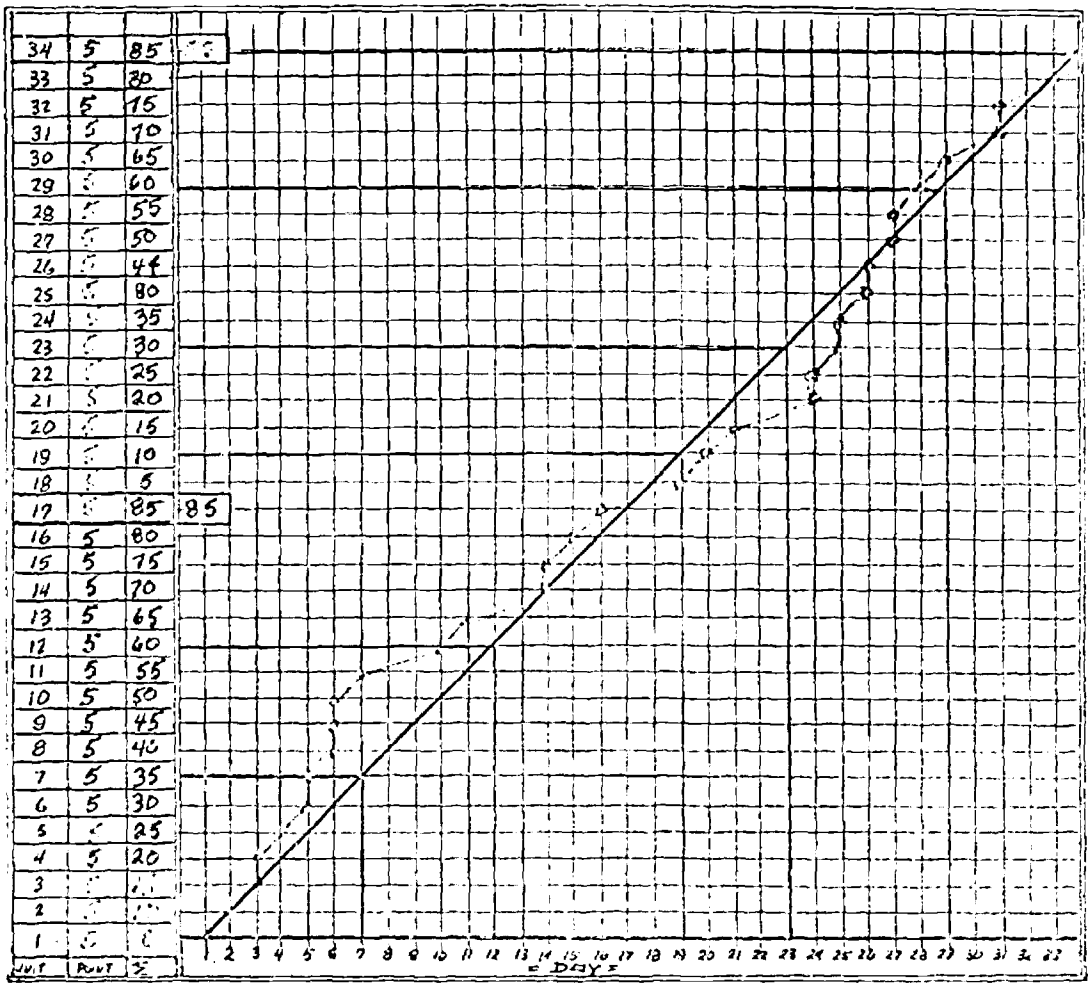
Charting Student Performance Rate



In the chart above the performance of a student on the readiness tests is shown. Each day a student took a readiness test, his proctor plotted the results. The chart above and on the following two pages are from the General Psychology class; 5, 4, and 3 points were given for passing form A, B and C of the readiness test respectively. The points given are recorded in the second column on the chart; a cumulative total is recorded in the third column. The first 17 readiness tests counted one hourly exam; the second 17 a second hourly exam. The student shown in the chart above was pressing to complete the course before the Christmas Recess. On ten days he took two readiness tests; three on one day. The days for taking the six hourly exams are not indicated on the chart.



In the chart above the performance rate of a student is shown who had some difficulty with the readiness tests. This student found it necessary to take seven form B and four form C readiness tests. Though this delayed him, he was able to complete on time by taking more than one readiness test on ten different days.



In the chart above the performance of a student is shown who was prone to drop work on his Psychology Course in favor of other demands on his time. Four different times during the semester he took no readiness tests for an entire week. By taking two or three at a time he was able to complete the course on schedule. The top students frequently reported that they really liked this flexibility in the utilization of their time.

APPENDIX D

DEVELOPMENT OF A PROGRAMMED COURSE

Preparation of Materials:

1. Choose reading material which can be readily comprehended by the student.
2. Divide materials into short (10-15 page) assignments.
3. Prepare study guides and study questions for each unit.
4. Prepare two or three forms of the quiz for each unit. Quiz should be 10-15 items, having several essay questions.

Course Proctors:

1. From the pre-registration list for your class choose good students whom you feel can work with other students. (Interview each student to be sure you have the type of individual you desire for the job.) Choosing proctors should be done several weeks before class begins.
2. Provide some incentive for the proctors' work. (Course credit, money, etc.)
3. Assign each proctor five or six students for whom he is responsible.
4. Have regular meetings (weekly) with the proctors to discuss the course materials, their student's progress, and the general operation of the programmed study system.

Program Operation:

1. Provide meeting rooms and times for the proctor and his students to meet.
2. Proctors provide study guides for each unit to be studied.
3. Proctors administer quizzes to students and grade answers.

4. Proctors discuss essay questions with student and answer any questions the student has regarding the subject matter or course procedures.

5. Proctors chart the student's progress on the student's individual cummulative graph.

6. Instructor provides and grades major exams when student has finished all work prior to exam.

Enrichment Activities:

1. Several lectures or demonstrations can be scheduled to add novelty to the students' class work routine.

2. Discussion groups can be added to provide the student with direct contact with the instructor and to provide the student with an opportunity to develop verbal skills in the subject matter field.

BIBLIOGRAPHY

1. Azrin, N. H. and Ayllon, T., The Token Economy: A Motivational System for Therapy and Rehabilitation. Appleton-Century-Crofts, New York, 1968.

2. Edwards, A. L., Experimental Design in Psychological Research, 2d Ed. New York: Rinehart & Company, 1960.

3. Ferster, C. B., Individualized instruction in a large introductory psychology course. Psychological Records, 1968, 18, 521-532.

4. Gallup, H. F., The introductory psychology course at Lafayette College, Easton, Pennsylvania: A description and tentative evaluation. Unpublished paper, 1969.

5. Johnston, J. M. and Pennypacker, H. S., A Behavioral Approach to College Teaching, Unpublished paper, 1970.

6. Keller, F. S., "Good-bye, Teacher..." Journal of Applied Behavior Analysis, 1968, 1, 79-89.

7. Kerr, Clark, Report of the Commission on Higher Education, The Carnegie Foundation, November, 1960.

8. Malott, R. W., and Svinicki, J. G., Contingency management in an introductory psychology course for one-thousand students. Psychological Record, Vol. 19, October, 1969. 545-556.

9. McMichael, J. S., and Corey, J. R., Contingency management in an introductory psychology course produces better learning. Unpublished paper, 1969.

10. Pressey, S. L., APA Convention Symposium on Teaching Machines and Programmed Instruction, Washington, D. C., 1955.

11. Skinner, B. F., Teaching machines, Science, 1958, 128, 969-977.

12. Skinner, B. F., The Technology of Teaching. New York: Appleton-Century-Crofts, 1968.

13. Crowder, Norman A., On the Differences Between Linear and Intrinsic Programming, Educational Science Division, U.S. Industries, March, 1963.

14. Wierzynski, Gregory H., New Campus Mood: From Rage to Reform. Time, Nov. 30, 1970.