DOCUMENT RESUME

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 950
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)

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AN EXPERIMENTAL EVALUATION OF PROGRAMMING STUDENT STUDY BEHAVIOR IN UNDERGRADUATE COURSES

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BRIDGEWATER, VIRGINIA
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AN EXPERIMENTAL EVALUATION OF PROGRAMMING STUDENT BEHAVIOR IN UNDERGRADUATE COURSES

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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 con-
cepts in teaching undergraduate course material.

The procedure involved constructing study units con-
taining a specific reading assignment and study guide ques-
tions. 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 readi-
ness 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 participa-
tion in the program, and (3) student attitude toward programmed
course. The project involved (1) the refinement of pro-
grammed 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 involv-
ing approximately 850 undergraduate students and six faculty
members over an 18 month period were involved in this inves-
tigation.

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

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, Prof-
essor Emmert Bittinger for his courses in Cultural Anthro-
pology, 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 exper-
iments, and strengthen what has already been done.

Educational institutions are being challenged to im-
prove 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 stu-
dents. Team teaching has been seen as a way to deal effective-
ly with increasing numbers of students in the classroom pro-
viding an individualized educational experience for many stu-
dents 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 atten-
tion to practicing what they preach by applying their technology
in the teaching of their own courses. Many psychologists com-
mitted to a behavioral technology have started applying such
a technology to their own teaching. However, the number sub-
jecting this effort to experimental scrutiny is, so far, pain-
fully small.

Programmed Instruction vs. Programmed Study:

Educational literature is rich with references to teach-
ing machines and programmed instruction. In programmed in-
struction -- 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 commit-
ment. 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.

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In this report a procedure for use with any standard text-
book 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 mater-
ials, regular standard textbooks have more frequently been em-
ployed. This feature permits a wide range of application and
great freedom of choice among available materials by the in-
structor.

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 the-
oretical structure to guide the preparation of stimulus mater-
ials 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 pro-
viding immediate feedback (reinforcement) for each student con-
cerning 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 main-
tenance of student study behavior was to allow the student to
pace himself in his program of study. He felt that this free-
dom 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 ques-
tions were whether contingency management can be used to teach
the subject matter of a standard text and whether or not stu-
dents would learn more. They concluded that students worked
harder, got better grades and enjoyed the course more.

HaLott and Svinicki (8) set up an extensive pro-
grammed 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. HaLott 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 Uni-
versity, which was similar to that employed by Keller. The
unique feature is the interview used to assess student under-
standing. 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 demon-
strate 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 perform-
ance 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 con-
secutive 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, Princi-
ples 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-

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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 in-
structor 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 re-
corded. 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 characteris-
tics 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 pro-
fessors 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 desir-
ability 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 edu-
cational research in general. Each concept to be assessed was
evaluated on ten scales described by Osgood, shown in Appen-
dix 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 com-
plete 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 con-

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 then, 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 give 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 criter-
ion 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) stu-
dents who had already taken the General Psychology
course and (2) students who were currently enrolled
in the course. These latter students had the high-
est 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 con-

siderable 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 text-books 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 disad-vantage 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 departrent. 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 per-
formance 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; teach-
ers 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 inves-
tigated. 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 discov-
ered too late to be remedied. In one course in which differ-
ent 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 question-
ing 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 pro-
grammed study procedure. In all cases the students enrolled
in a particular course were ranked according to their cumula-
tive 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 Psychol-
ogy 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, Anthro-
   pology, 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 stu-
   dy 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 readiness 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. <u>Pacing</u>: No change.

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

9. <u>Formal Class Meetings</u>: Eight times during the
   semseter, generally after an hourly exam, the pro-
   grammed study group met together with the instructor.

<u>Development of the Educational Psychology Program</u>:

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

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

3. <u>Hourly Exams</u>: Three 50-item multiple-choice exams
   were given.

4. <u>Readiness Tests</u>: 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. <u>Passing Criterion</u>: A score of 75 percent was re-
   quired for passing. Students were not required to
   take and pass all readiness tests in order to progress
   through the course.

6. <u>Credit for Readiness Tests</u>: Same as for Anthro-
   pology.

7. <u>Pacing</u>: Hourly exams were available during any readi-
   ness test period. Work had to be completed by the
   end of the semester.

8. <u>Proctors</u>: Same as for first semester Anthropology

9. <u>Formal Class Meetings</u>: None.

<u>Development of the Principles of Sociology Program</u>:

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

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 en-
    couraged 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 con-
    tained the study assignment and discussion questions
    to point up important aspects of the assignment.
    Reading assignments were in Noss, 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 assignments. 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 Psych-
ology was used to examine the usefulness of small group dis-
cussions within a programmed study format.

The group discussion was seen as the way of adding addi-
tional 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 dis-
cussion 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 ex-
perience 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 con-
tact 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 discus-
sion 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 dis-
cussion 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 experi-
ence 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 re-
ward aspects of the group discussion experience as used in our
program. The hoped for effect was that the student would be-
come 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. In-
cluded 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 mini-mize 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 Psychol-ogy courses, the Educational Psychology course, and the second semester of Cultural Anthropology showed a statisti-cally significant difference with the programmed study sec-tions 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 1,3,4) 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		X	Unit size, proctor
5	Educational Psychology	1	100	15	4	50:1			
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 pre-
ceeding 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								Kolmogorov-Smirnov χ^2
			0-10	20	30	40	50	60	70	80 up	
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	
		Lecture	0	3	5	22	14	33	19	3	4.44*

* Significant at .05 Level of Confidence
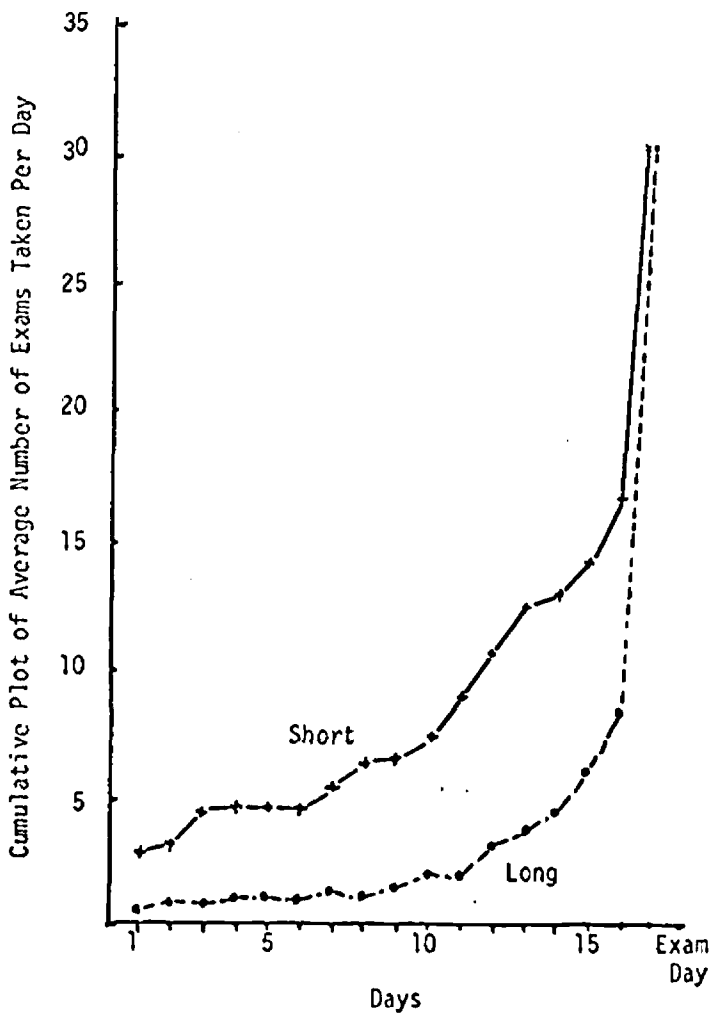
Figure 1. Cumulative mean work rate per day as a function of assignment length in Educational Psychology (line 6)

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	85.85	4.42*
GPA Level	3	235.85	
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	4.30*
GPA Level	2	820.54	
Method X Level	2	59.63	
Error	24	586.31	
Total	29		

* P<.05
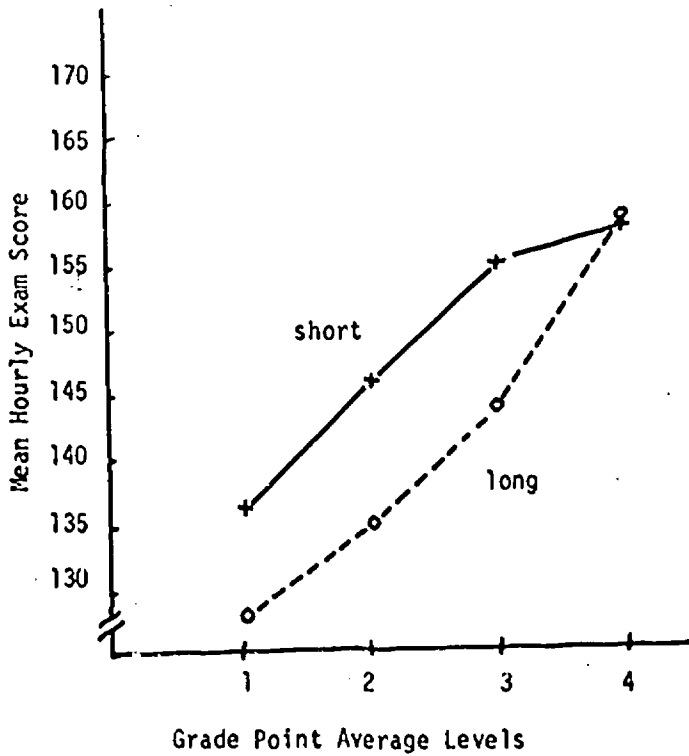
Figure 2. Mean hourly exam performance as a function of assignment length and GPA level in Educational Psychology
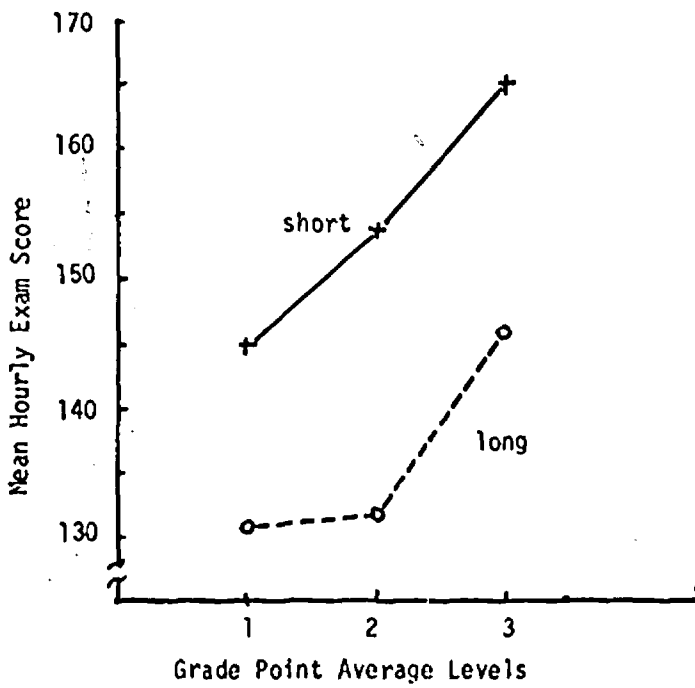
Figure 3. Mean hourly exam performance as a function of assignment length and GPA level in General Psychology.

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	23.63	1.341	28
		% Passed of those Attempted	62.00	13.33	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	93.72	10.65	96.53	8.19	1.157	53

readiness tests was computed.   This data revealed changes
in participation across the semester.   Table 8 presents
the percent participation in the programmed sections by indi-
vidual 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 per-
cent 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	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	Mean %
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	65	80					95
8	Cultural Anthropology	98	93	82	75	70	66	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

Study Unit Number

** 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	83	89	64	77	71	75	33	52	60	70	67	73	61	80	81												75
5	Educational Psychology	95	93	**	93	**	**	**	98	**	97	95	93	**	**	97	96	**	97	97	82	**	83	**	98							97
8	Cultural Anthropology	65	75	82	94	69	74	79	82	89	84	73	87	32	60	67	53	35	63	74	66	55	58	46	73	57	75	73	68			67
10	Prin. of Sociology	91	95	74	80	70	83	72	95	78	82	62	**	97	78	83	69	68	46	**												81
12	Religions of the World	85	61	77	93	89	54	68	89	74	62	90	33	97																		79

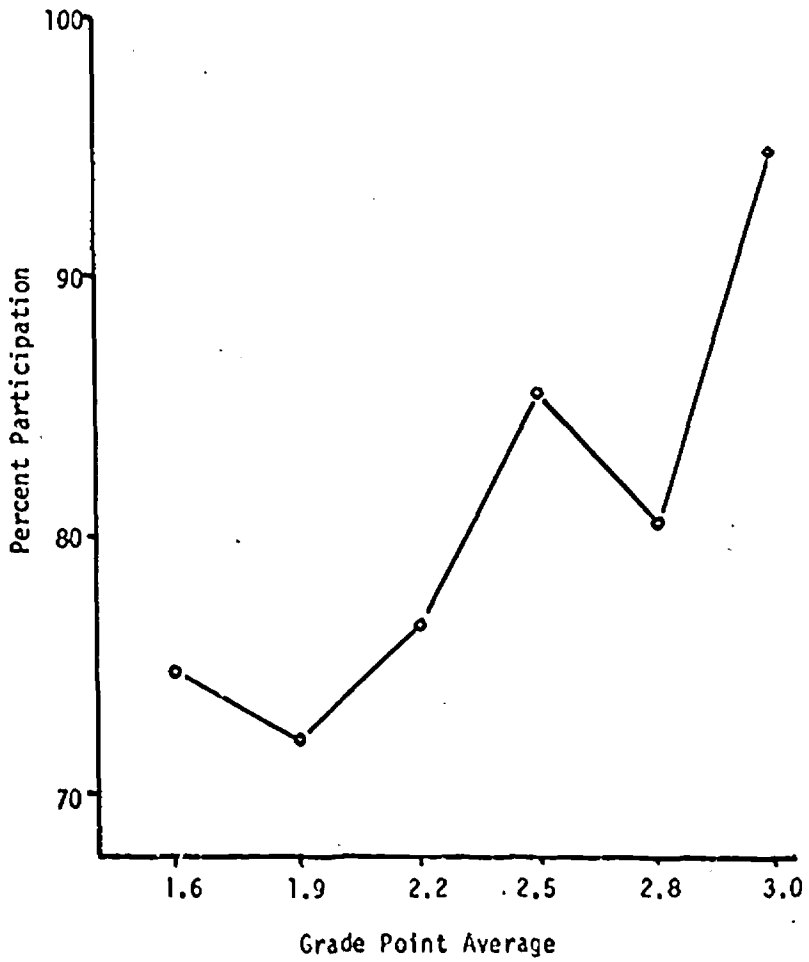** Indicates 100% of Units Attempted were Passed

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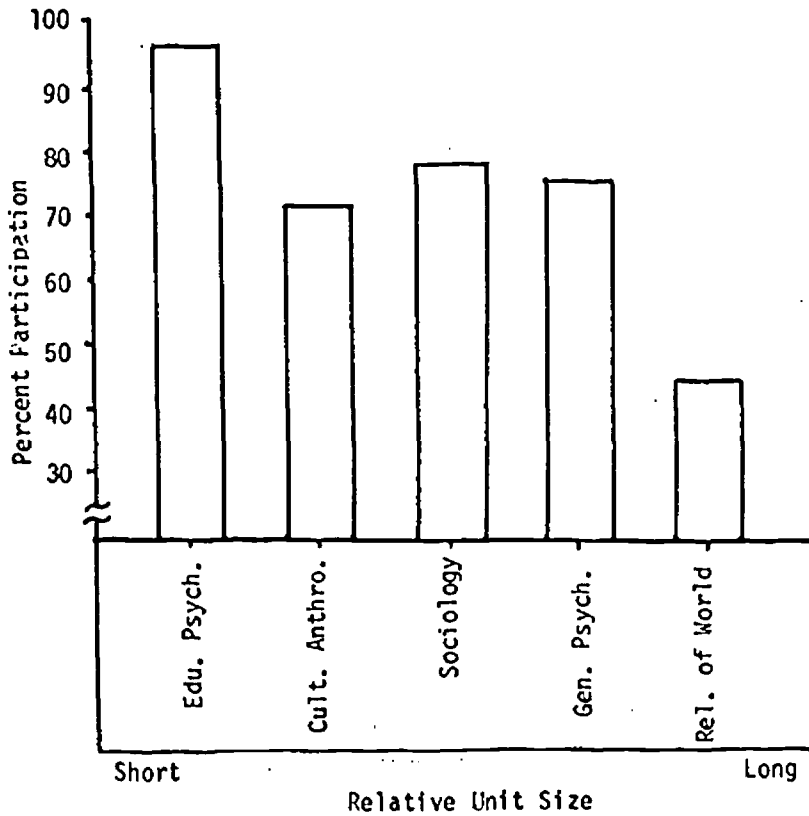
Figure 5. Graph of the percent participation as a function of study unit length in five programmed study courses in which the request to take readiness tests was not mandatory for taking hourly exams.

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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 8)

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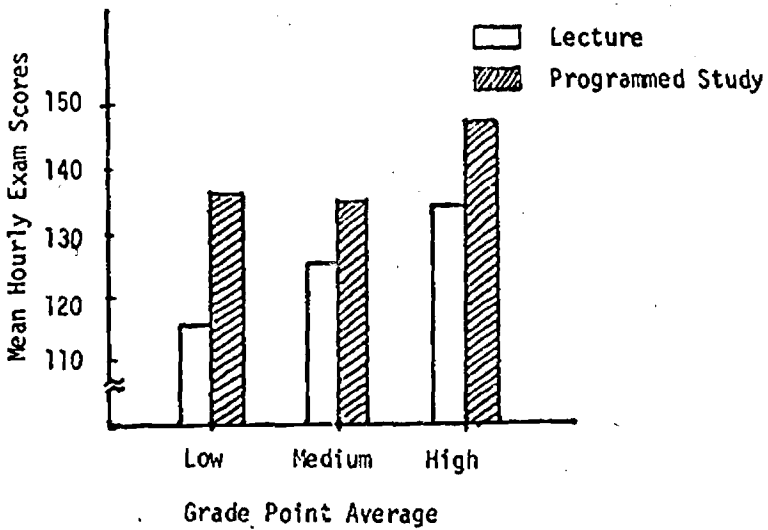
Figure 7. Comparison of Lecture and Programmed Study
Sections of Cultural Anthropology, Second Semester
(line 9)

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 semes-
ter 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 program-
med 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 vari-
ance 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 readi-
ness 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

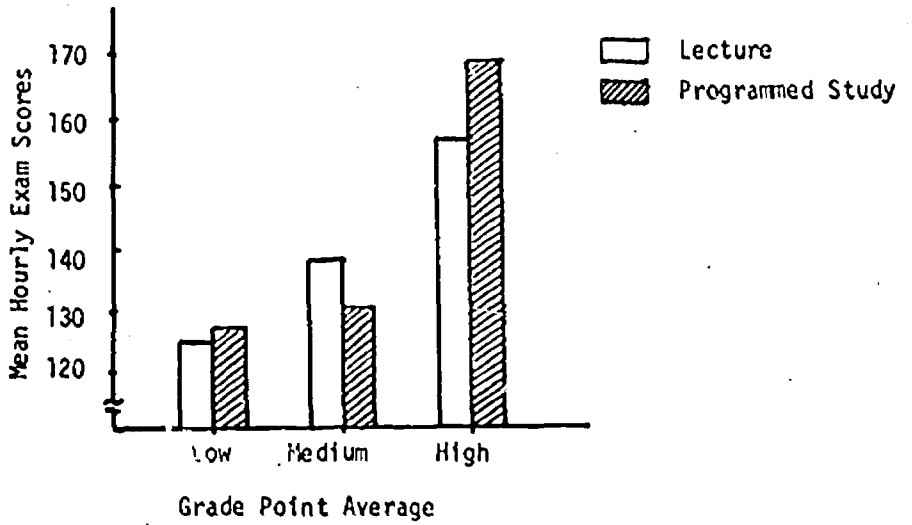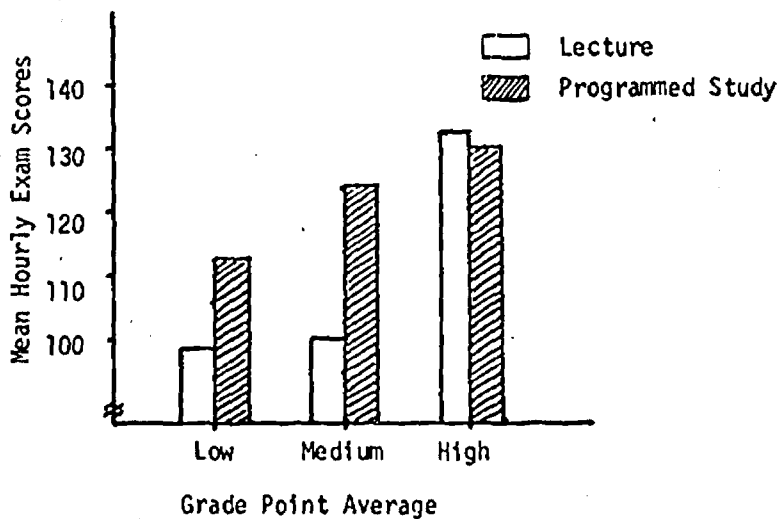Figure 8. Comparison of Lecture and Programmed Study
Sections of General Psychology, Third Semester (line 3)

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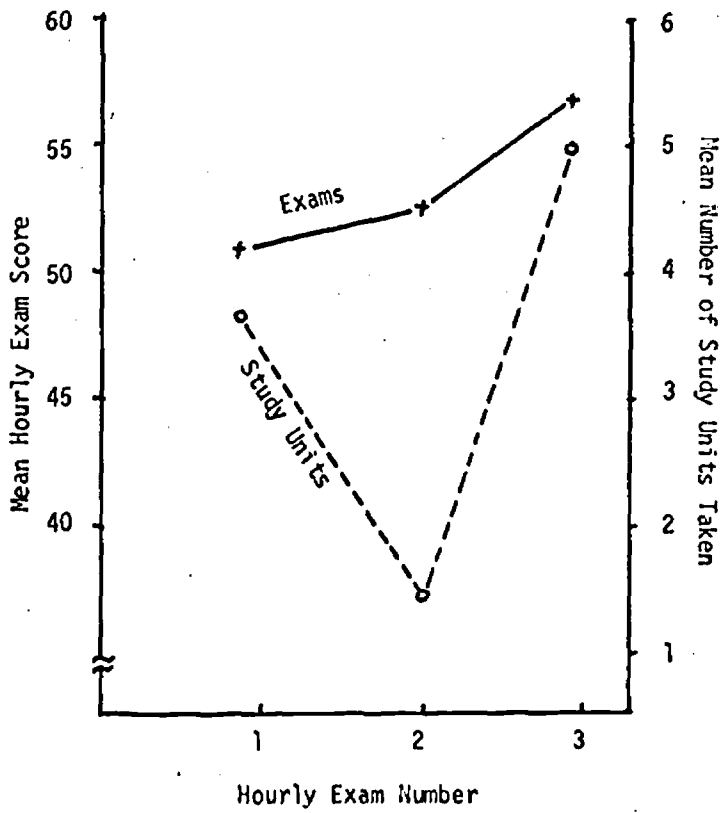
Figure 9. Mean performance on three hourly exams in Principles of Sociology compared with mean number of study units taken prior to the exam. (line 11)

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	3.33 ~~6.33~~	0.65	3.55 ~~6.55~~	0.92

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%

o—o 1st Semester
▲—▲ 2d Semester
o—o 3d Semester
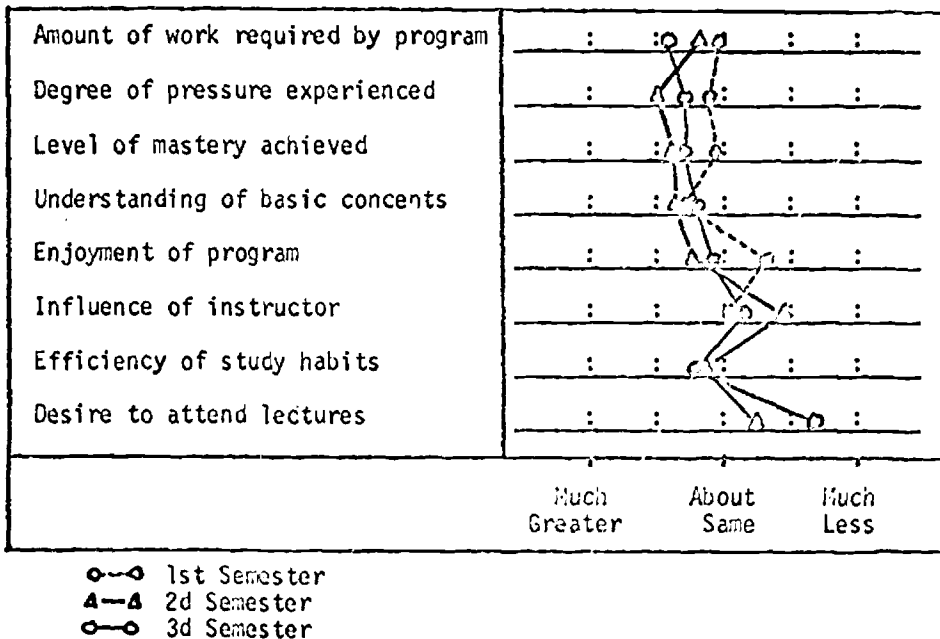
Figure 11. Summary of Student Attitudes Toward
Programmed Study Courses in Three Semesters of
General Psychology

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 dif-
ference 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, where-
as 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 mater-
ial 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, where-
as 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 sec-
tion for some reason other than that of instructional tech-
nique.

In Figure 14 the percent of successful participation

	Much Greater	About Same	Much Less
Difficulty of Programmed Course			
**Level of Mastery in Programmed Course			
Final Grade made possible by a Programmed Course			
Degree of Pressure Experienced in Programmed Course			
Amount of Work Required by a Programmed Course			
**Understanding of Basic Concepts in Programmed Course			
**Enjoyment of Programmed Course			
Influence of Instructor in Programmed Course			

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.

	Much Greater	About Same	Much Less
**Difficulty of Programmed Course			
**Level of Mastery of Programmed Course			
Final Grade made possible by a Programmed Course			
Degree of Pressure Experienced in Programmed Course			
Amount of Work Required by a Programmed Course			
Understanding of Basic Concepts in Programmed Course			
**Enjoyment of Programmed Course			
**Influence of Instructor in Programmed Course			
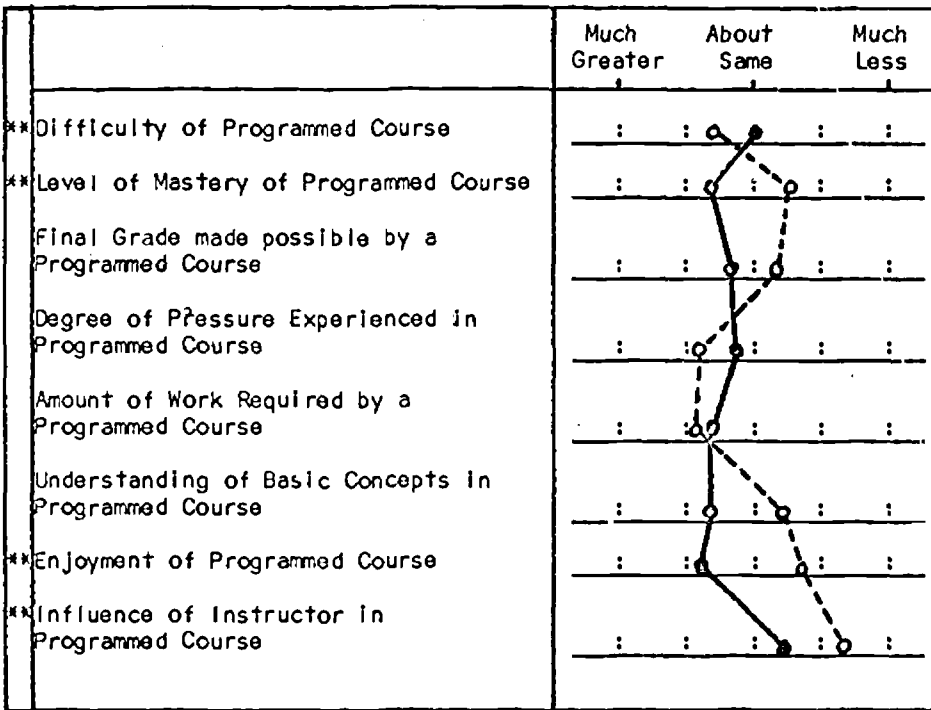
Figure 13. Pre-course Summary of Student Attitudes Toward
Programmed Study Course, Religions of the World.
●——● Programmed Section, o--oLecture Section.
**Indicates a significant t at P<.05.

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

76
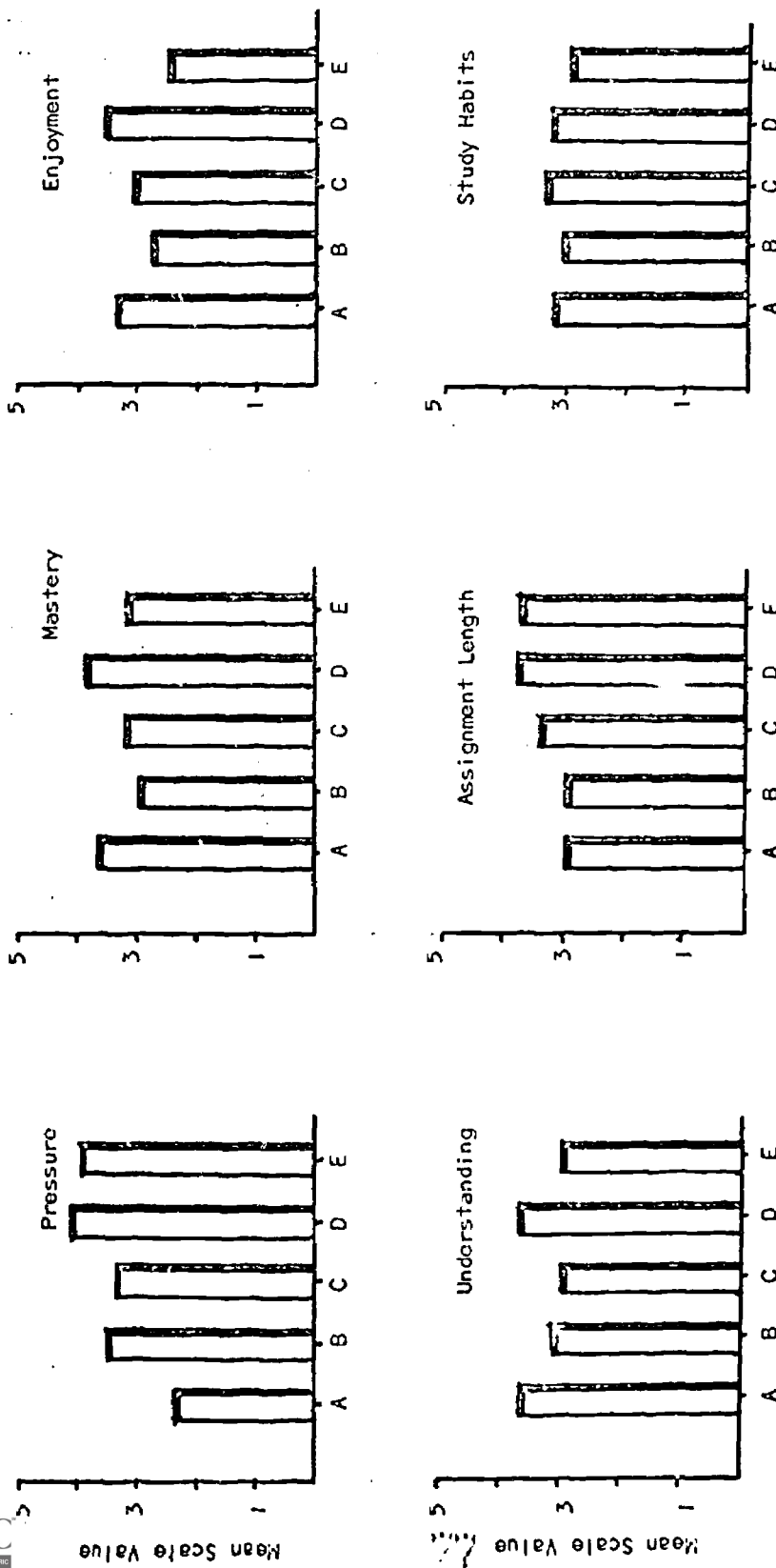
Figure 14. Student attitude on a five point scale is recorded for
five courses ranked according to mean percent successful participation for
the class for six attitude categories. A=Educational Psychol., B=Sociology,
C=Religions of the World, D= General Psychol., E=Cultural Anthropology

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 dimen-
sions 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 pro-
grams. 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 compar-
ison 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 respond-
ed more favorably to the concept of Anthropology and the
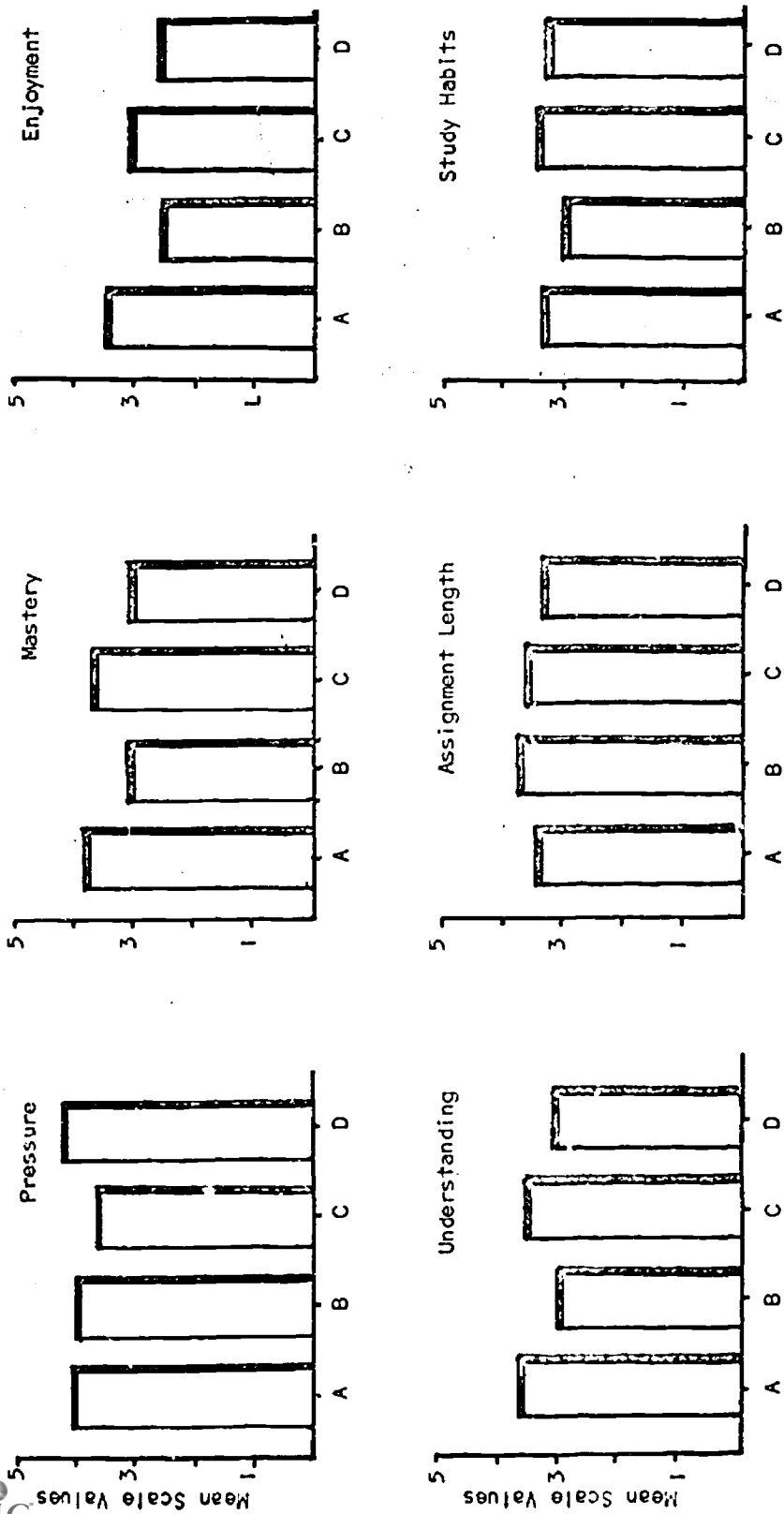
Figure 15. Student attitude on a five point scale is recorded for two courses each of which was conducted early in the program and again in the final semester of the program. A=General Psychology, B=Cultural Anthropology, C=General Psychology, 3d semester, D=Cultural Anthropology, 2d semester.

Cultural Anthropology

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

Bad .... Good

Principles of Sociology

Word being Evaluated	P	Mean Scale Value
Sociology	NS	
Fun	NS	
Studying Sociology	NS	
Way course is Taught	NS	
Evil	NS	
Lecture	NS	
Programmed Study	NS	
Student Proctor	NS	
Participating in Research	.05	
Dorm Life	NS	
Course Professor	NS	
Educational Research	.05	

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 educa-
tional research. Student attitude towards all other con-
cepts 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 pro-
grammed 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 Achievement	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 Attend 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 participa-
tion and performance. From this work it is evident that effec-
tive 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 Psychol-
ogy 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 satis-
faction which accompanied this academic success.

From our observations of the program in General Psy-
chology it would appear that one important aspect of the pro-
grammed 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 occa-
sions 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 tech-
nique seems to gain much of its power from the fact that it
aids the student to schedule his study time in a more effec-
tive 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 Psy-
chology program. In each case both the proctor and the stu-
dent 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 assign-
ment. The students viewed this proctor role as one which
added nothing to their enjoyment of the course or to their aca-
demic 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 stu-
dents they proctored also recognized them as valuable contri-
butors 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 instruc-
tional 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 assoc-
iated 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 pres-
sure 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 in-
spection 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 lec-
ture course as well. In the lecture format the student con-
centrates 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 remem-
bering 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 Anthro-
pology 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 pro-
ductivity 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 in-
creased performance level. The students in the short assign-
ment group studied more regularly and also studied less mater-
ial 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 comprehen-
sion 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 assign-
ment 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 re-
lation 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 con-
dition 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 sur-
rounding 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 de-
sirable 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 class-
room.

An example of the influence of the educational contin-
gency in regards to student participation is seen in the vol-
unteer program of the Sociology class. Students during
the first two-thirds of the semester were given the opportun-
ity to take the quizzes and were encouraged to take the
quizzes. As shown in Figure 7 the participation in quiz
taking was very low prior to the first exam and fell drasti-
cally prior to the second exam. After the second exam the
instructor required the students to take and pass the remain-
ing quizzes in order to have access to the third exam. A con-
tingency was established for the performance - consequent in-

teraction of quiz taking and availability of the third exam.
As can be seen in Figure 7, 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 pre-
vious 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 re-
sponse 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 care-
ful reading of the text materials assigned and the other re-
sponse related to the skills of demonstrating his acquired in-
formation. 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 re-
sponses 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 re-
sponses are related to passing the quiz. The oral and choice
responses to a question which are part of the quiz taking pro-
cedure 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 consid-
er 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 stud-
ent 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 com-
parison 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 per-
centage 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 main-
tained a chain of events which terminated in this act of pas-
sing 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 some-
one 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 reinfor-
cer 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 rein-
forcers in this educational chain of events.

One final reinforcer which students describe is that of
schedule flexibility which the programmed course gave the stu-
dent to arrange his schedule of activities. This reinforcer
seems to be gained because the student can escape the aver-
siveness of having great amounts of work that must be completed
at one particular time within a semester or a week. A stu-
dent 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. 101

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' pas-
sing 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 be-
came 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 pro-
blem. Evaluation generally is directly related to the pro-
cess 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. Eval-
uation as a consequence is also concerned with reliability of
measurement, but not in the same way as those who use evalua-
tion 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 dif-
ferent 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 desig-
nated 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 com-
pleted. 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 inde-
pendent 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 education-
al system itself. Evaluation becomes one of the major
motivating influences in the programmed study procedure.

In our evaluation procedures we have shifted from com-
pletely multiple-choice quizzes to a combination quiz composed
of both multiple-choice and essay question. The essay ques-
tions 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 mat-
ter. Michael's technique is to provide extensive study
guides directing the student's attention to all the con-
cepts 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 impor-
tant 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 com-
plaints which students made concerning the method. These
complaints were few, but frequent enough to keep the adminis-
tration 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 adminis-
tration 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 re-
actions to this new method of instruction. Some showed in-
terest in the method and were willing to try the procedure in
their own classes. Other members of the faculty were con-
cerned that the new teaching procedure required so much stu-
dent 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 skep-
ticism. They were interested in a new approach to instruc-
tion. They especially liked the fact that Bridgewater Col-
lege 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 polarized at the end of the first
year during which the programmed study method was used. The stu-
dent newspaper carried articles which reflected dissatisfac-
tion 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   D. less
    B. greater   E. much less
    C. about the same

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

22. Where do you study?

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

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   D. yes, with 3 other persons
    B. yes, with 1 other person   E. yes, with 4 other persons
    C. yes, with 2 other persons

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

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

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

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

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

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

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.

	Student Number
9 8 7 6 5 4 3 2 1 0	
9 8 7 6 5 4 3 2 1 0	
9 8 7 6 5 4 3 2 1 0	
9 8 7 6 5 4 3 2 1 0	

WAY COURSE IS TAUGHT

cold	hot
good	bad
tense	relaxed
wet	dry
fresh	stale
angular	rounded
weak	strong
rough	smooth
active	passive
small	large

EVIL

cold	hot
good	bad
tense	relaxed
wet	dry
fresh	stale
angular	rounded
weak	strong
rough	smooth
active	passive
small	large

LECTURE

cold	hot
good	bad
tense	relaxed
wet	dry
fresh	stale
angular	rounded
weak	strong
rough	smooth
active	passive
small	large

APPENDIX C

Charting Student Performance Rate
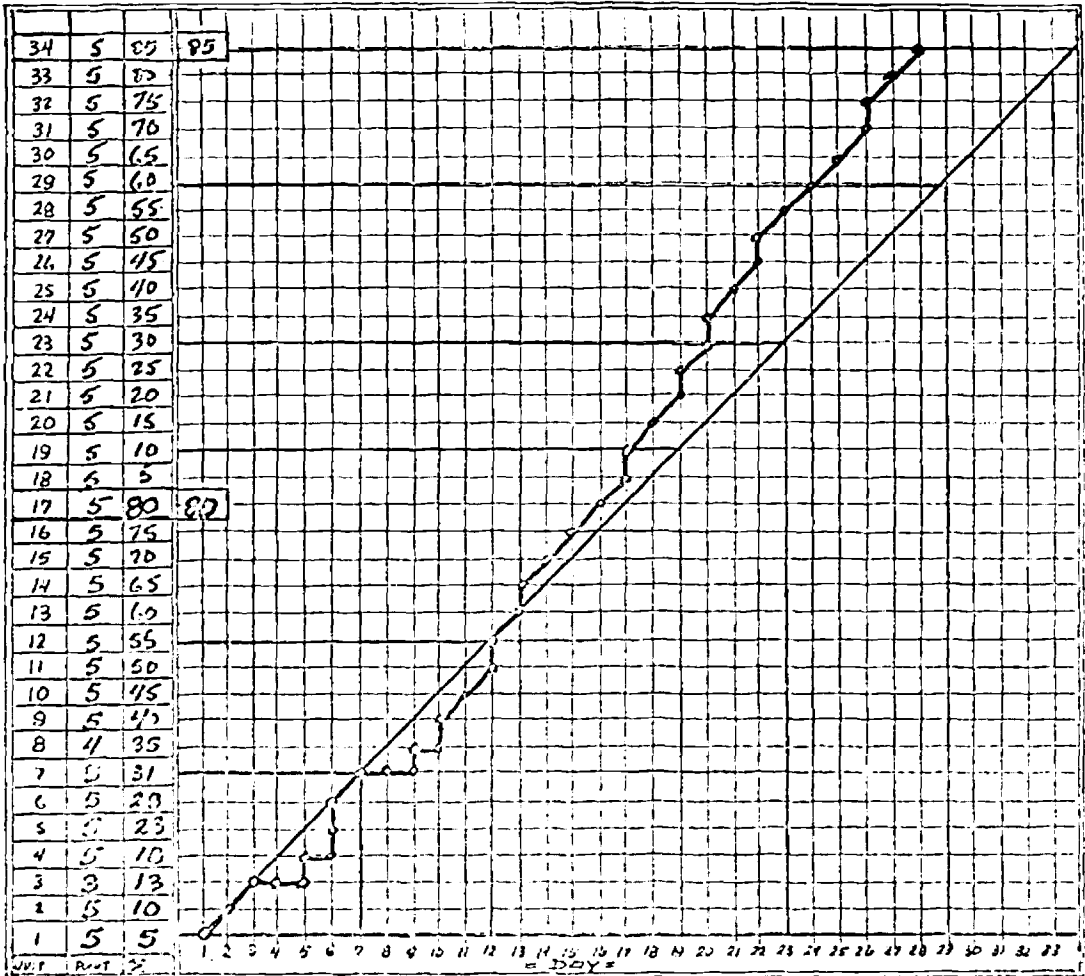
In the chart above the performance of a student on the readiness
tests is shown. Each day a student took a readiness test, his proctor
plotted the results. The chart above and on the following two pages
are from the General Psychology class; 5, 4, and 3 points were given
for passing form A, B and C of 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.

UNIT	POST	%		
34	5	74	74	
33	5	79		
32	5	74		
31	5	69		
30	5	64		
29	5	59		
28	5	54		
27	5	49		
26	5	44		
25	5	39		
24	5	34		
23	5	28		
22	5	24		
21	5	19		
20	4	14		
19	5	10		
18	3	5		
17	3	75	75	
16	5	72		
15	5	67		
14	5	62		
13	4	57		
12	5	53		
11	5	48		
10	5	43		
9	3	38		
8	5	35		
7	5	36		
6	3	25		
5	5	22		
4	3	17		
3	5	14		
2	4	9		
1	5	5		

DAY #: 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 30 31 32 33
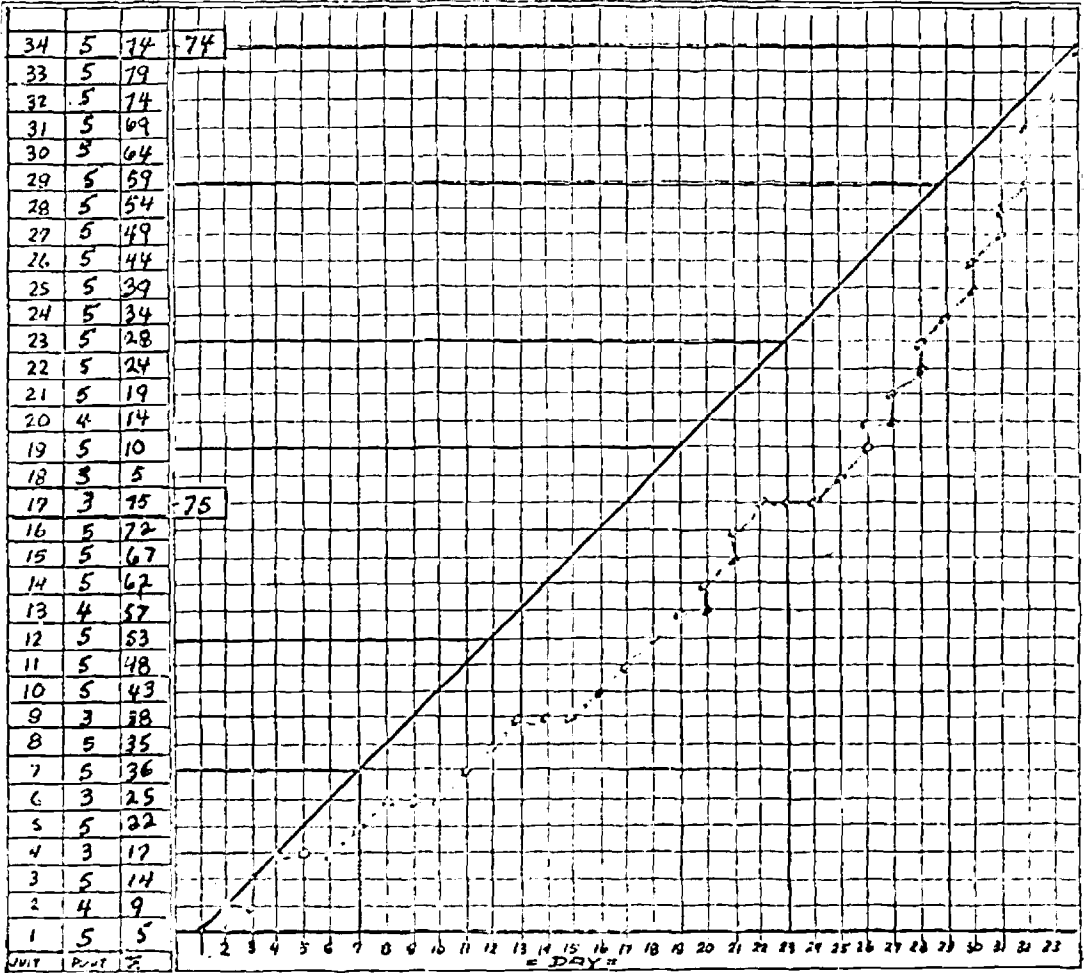
In the chart above the performance rate of a student is shown who had some difficulty with the readiness tests. This student found it necessary to take seven form B and four form C readiness tests. Though this delayed him, he was able to complete on time by taking more than one readiness test on ten different days.

34	5	85	
33	5	80	
32	5	75	
31	5	70	
30	5	65	
29	5	60	
28	5	55	
27	5	50	
26	5	45	
25	5	80	
24	5	35	
23	5	30	
22	5	25	
21	5	20	
20	5	15	
19	5	10	
18	5	5	
17	5	85	85
16	5	80	
15	5	75	
14	5	70	
13	5	65	
12	5	60	
11	5	55	
10	5	50	
9	5	45	
8	5	40	
7	5	35	
6	5	30	
5	5	25	
4	5	20	
3			
2			
1			
DUE	POINT		

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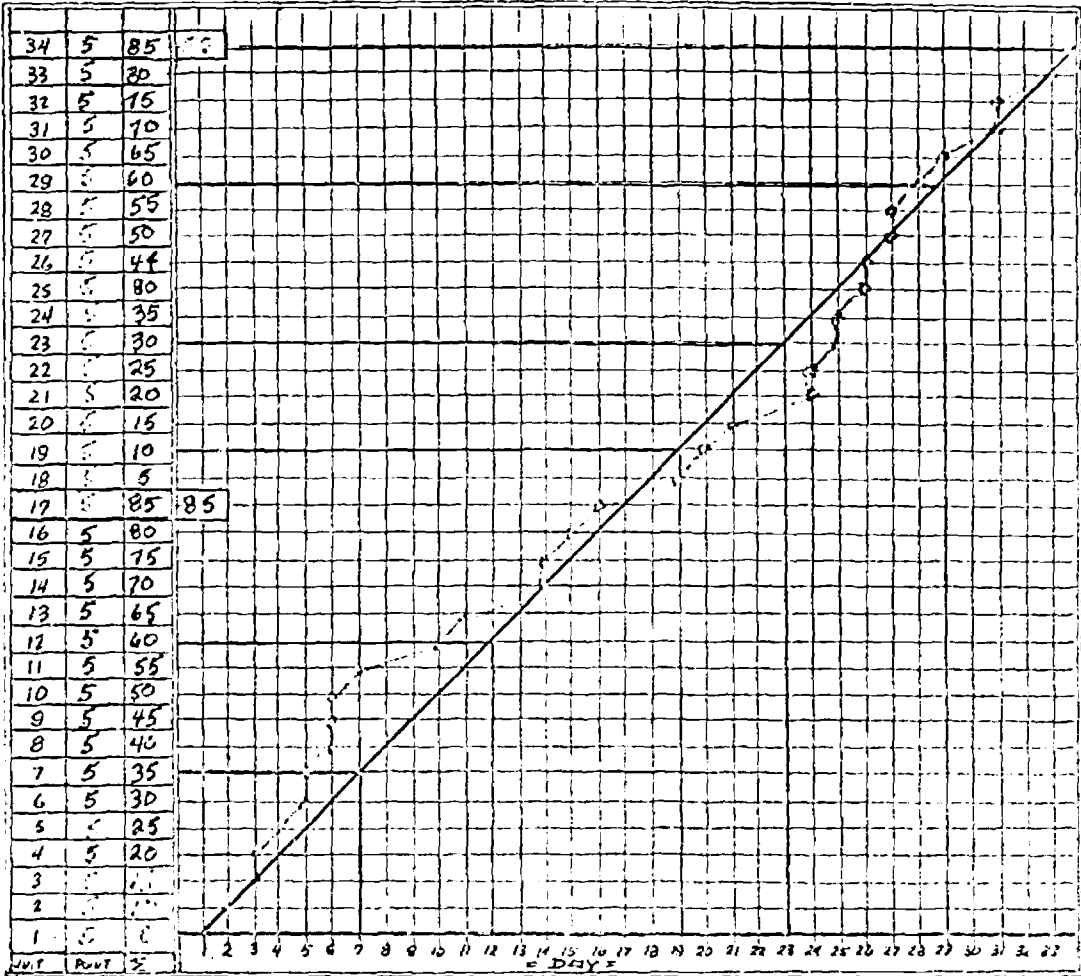
In the chart above the performance of a student is shown who was prone to drop work on his Psychology Course in favor of other demands on his time. Four different times during the semester he took no readiness tests for an entire week. By taking two or three at a time he was able to complete the course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

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APPENDIX D

DEVELOPMENT OF A PROGRAMMED COURSE

Preparation of Materials:

1. Choose reading material which can be readily compre-hended by the student.

2. Divide materials into short (10-15 page) assign-ments.

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.

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