EFFECTS OF A LEARNING CENTER METHOD VERSUS LECTURE METHOD OF TEACHING AS RELATED TO ACHIEVEMENT, SELF-CONCEPT, AND ATTITUDE OF COLLEGE FRESHMEN

DISSERTATION

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements For the Degree of

DOCTOR OF PHILOSOPHY

By

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The major problem of this study involved a comparison of two methods of teaching English and biology to college freshmen. Subproblems investigated in this study involved the apparent influence of each method of teaching on achievement in each course, on the self-concept of the student, on the students' attitude toward college and toward the learning center, and the effect of the commuter-resident status on achievement, self-concept, or attitude.

The purpose of this study was to assess the efficacy of the experimental method of teaching to achieve desired growth in academic achievement of first-semester college freshmen enrolled in English or biology.

College A, from which the experimental group was chosen, opened one of the largest and most modern remote access information storage and retrieval systems in 1969-70. Due to the utilization made by College A of the learning center, it was not feasible to select a control group on the same campus as the experimental group. College B, from which
the control group was chosen, was selected from a group of colleges in the Southwest which most closely resembled College A. College A and College B were both accredited, senior, co-educational, liberal arts colleges operating under the auspices of the same sectarian board.

First-semester freshmen without previous college experience who were enrolled in first-semester English or biology served as subjects. Pretests and posttests were administered to all of these subjects. The Cooperative English Tests, 1960 Revision, Form IA, was used to measure achievement in English. The Nelson Biology Test, Form E, was used to measure biology achievement. The Tennessee Self Concept Scale, Clinical and Research Form, was used to measure self-concept. A semantic differential was designed to measure the student's attitude toward both college and the learning center.

Hypotheses formulated to carry out the purposes of this study were designed to reveal any differences in achievement for English or biology students as well as any possible changes in self-concept or attitude. The basic design of the study was a pretest-posttest control group design. Descriptive data obtained from the students confirmed the expected difference in the percentages of resident and commuter students at the two colleges. Consequently, a 2 X 2 factorial design utilizing method of
instruction as one factor and resident-commuter status as the other factor served as the basic design for analyzing data. No attempt was made to equate the two faculties involved in the study.

Findings in the study indicated that achievement in English was significantly higher for the experimental group than for the control group. The study indicated there was no significant difference between the two methods of teaching biology. Neither method of instruction seemed superior with respect to a positive change in self-concept. The control group demonstrated a significantly greater positive change than the experimental group in attitude toward college. The experimental group demonstrated a significant decline in attitude toward the learning center.

Based upon the results of this study it was concluded that there was not sufficient supportive data to recommend one method of teaching over the other method, following this one-semester study.
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CHAPTER I
INTRODUCTION

As a coed sits down at her learning carrel, places a headset over her ears, and dials a code number, she embarks upon a new experience in the world of education. She may have chosen to view a professional production of a Shakespearean play, a lecture by a famed scientist, a remedial learning unit prepared by a local professor, or to participate in a televised class from a neighboring institution. But how much is she actually learning?

The 1969-70 academic year saw College A, from which the experimental group was selected, open one of the largest and most modern learning centers in the nation. Seminar rooms, conference rooms, library stacks, audio and video equipment, individual carrels, faculty offices, and student lounge areas were all housed in the same building. Flexibility was a key word throughout the development of this tool for higher education.

Now that the center has been in operation for three years, what have been the results? This study, which was only a beginning of the total evaluative processes, proposed to examine some of the results.
Statement of the Problem

This study involved a comparison of two methods of teaching English and biology to college freshmen. Sub-problems investigated in this study were as follows:

1. the apparent influence of each method of teaching upon achievement in each course;
2. the apparent influence of each method of teaching on the self-concept of the student;
3. the apparent influence of each method of teaching on the attitude of each student;
4. the apparent influence of commuter or resident status on the student's achievement, self-concept, or attitude; and
5. the change in attitude toward the Learning Center of the students in the experimental group.

Purpose of the Study

The purpose of this study was to assess the efficacy of the experimental method of teaching to achieve desired growth in academic achievement of first-semester college freshmen enrolled in English or biology. Affective and cognitive growth comprise a large part of academic achievement; therefore, this study was concerned with the changes in these areas.

The following questions were used as guides for the one-semester study:
1. Does there exist a significant difference in the achievement level of first-semester freshmen in English or biology under the two methods of instruction as determined by the selected instruments?

2. Does either method of instruction have a greater influence on the development of self-concept?

3. Does either method of instruction have a greater effect on the attitude of the students toward college in general?

4. Does the attitude of the experimental group toward the Learning Center change during the study?

Hypotheses

The ACT English score, the pretest score on the Cooperative English Tests, the pretest score on the Tennessee Self Concept Scale, and the pretest score on the Semantic Differential: COLLEGE were used as covariates to determine the change in achievement for English. The ACT Natural Science score, the pretest score on the Nelson Biology Test, the pretest score on the Tennessee Self Concept Scale, and the pretest score on the Semantic Differential: COLLEGE were used as covariates to determine the change in achievement for biology. The following hypotheses were formulated to carry out the purposes of this study:
1. The experimental group* will achieve a significantly higher adjusted posttest mean, after one semester, than will the control group** on the following:
   a. Cooperative English Tests

2. The experimental commuter group*** will achieve a significantly higher adjusted posttest mean, after one semester, than will the control commuter group**** on the following:
   a. Cooperative English Tests

3. The experimental resident group***** will achieve a significantly higher adjusted posttest mean, after one semester, than will the control resident group****** on the following:
   a. Cooperative English Tests

For hypotheses 4 and 5, the covariates used in hypotheses 1, 2, and 3 served as covariates for the parts related to English and biology. The pretest score for the specific instrument under consideration was the only

*Hereafter called Group Ex.
**Hereafter called Group Ct.
***Hereafter called Group Excm.
****Hereafter called Group Cctcm.
*****Hereafter called Group Exrs.
******Hereafter called Group Ctrs.
covariate used in each of the parts related to self-concept or attitude.

4. There will be no significant difference in the adjusted posttest means between Group Excm and Group Exrs, after one semester, on the following:
   a. Cooperative English Tests
   b. Nelson Biology Test
   c. Tennessee Self Concept Scale
   d. Semantic Differential: COLLEGE
   e. Semantic Differential: THE LEARNING CENTER.

5. There will be no significant difference in the adjusted posttest means between Group Ctcm and Group Ctrs, after one semester, on the following:
   a. Cooperative English Tests
   b. Nelson Biology Test
   c. Tennessee Self Concept Scale
   d. Semantic Differential: COLLEGE.

6. There will be a significant mean change between pretest means and posttest means on the Tennessee Self Concept Scale favoring the experimental group, after one semester, between the following:
   a. Group Ex and Group Ct
   b. Group Excm and Group Ctcm
   c. Group Exrs and Group Ctrs.

7. There will be a significant mean change between pretest means and posttest means concerning
attitude toward COLLEGE, after one semester, in favor of the experimental group between the following:

a. Group Ex and Group Ct
b. Group Excm and Group Ctcm
c. Group Exrs and Group Ctrs.

8. There will be a significant mean change between the pretest mean and posttest mean, after one semester, concerning attitude toward THE LEARNING CENTER of the following:

a. Group Ex
b. Group Excm
c. Group Exrs.

Background and Significance

Dial or remote access information retrieval systems were an outgrowth of the language laboratory. The first reference to a language laboratory was to one at Green Mountain Junior College, Poultney, Vermont (5). Grand Valley State College in Allendale, Michigan, had the first recorded system with both audio and video capabilities. In 1965, Oral Roberts University in Tulsa, Oklahoma, opened a six-story Learning Center with 130 carrels. That same year Oklahoma Christian College in Oklahoma City opened a system with 870 carrels limited to audio access only (13).
A preliminary search of related literature showed that S. N. Postlethwait of Purdue University seemed to be the pioneer of the learning center approach in science.

McGrath (10, pp. 3-27) stated that the Learning Center is the only implement on today's academic scene capable of meeting the needs of the slow learner, the academically talented, the unqualified student, the failures, the voluntary drop-outs returning to school, and those choosing to continue their education, as well as the other diversified groups of today's America. The ability of a learning center to provide self-paced instruction, a larger opportunity for curricular interests, and an education at irregular hours of attendance makes the learning center an indispensable tool for the development of Dewey's active learning.

Stanford North (12, pp. 55-74) said that no one seemed to know much about the evaluation of learning centers and that there were perhaps three variables that should be considered—method, materials, and arrangement. Evaluators should be interested in effects which North categorized as learning outcomes, attitudes, and usage. Learning outcomes and attitude effects were of primary importance in this study.

Achievement, self-concept, and attitude correlations were not intended as a part of this study in light of the large number of completed studies involving different aspects of these three ideas. However, the changes in
achievement, self-concept, and attitude of the students involved in each method, especially the learning center method, were deemed significant to education. If a teacher were freed from the task of continually dispensing information in order to become a counselor, a diagnostician, a prescriber of individual learning experiences, and a motivator, which is an objective of the learning center, then a student might be able to progress through education and receive something besides content memorization that has too often been the prevalent objective of today's college curriculum (9).

The increase in the number of remote access retrieval systems during the last decade has necessitated research concerning the effectiveness of the total system. This study was planned as a step in determining the effectiveness of this type of installation.

Definition of Terms

**Experimental method** refers to the method of presentation at College A. This presentation, primarily an audio-video taped presentation, was available to students on an individual, small group, or class basis.

**Learning Center** as used in this study refers to the electronic facility utilized at College A as media for implementing curriculum.
Control method will refer to the lecture-discussion method of instruction predominant at College B. This method allowed the lecturer to employ visual aids as a supplement to the oral presentation (7).

English achievement is indicated by a score obtained on the Cooperative English Tests.

Biology achievement is indicated by a score obtained on the Nelson Biology Test.

Self-concept is indicated by a score obtained on the Tennessee Self Concept Scale.

Attitude refers to the mean score obtained on a semantic differential.

Favorable attitude toward a concept is a mean score greater than or equal to 4.5.

Unfavorable attitude toward a concept is a mean score less than or equal to 3.5.

Neutral attitude toward a concept is a mean score between 3.5 and 4.5.

Resident student as used in this study is a student living in a residence hall owned or operated by the college.

Commuter student as used in this study is a student who is not a resident student.

Limitations

This study was limited to the freshman students of two private church-related institutions who entered college
for the first time in the fall semester of 1971 and who were enrolled in first-semester English or biology.

The denominational board governing College A, from which the experimental group was chosen, governed other senior colleges in the same area of the Southwest, one of which was College B, from which the control group was chosen.

The selection of a control group at College A was not feasible since all freshmen at College A received at least part of their instruction via the learning center method of instruction.

The figures in Table XIX, included in the Appendix, show comparative enrollment data for the fall semesters of 1969, 1970, and 1971 for College A and College B. The other colleges under the denominational board did not compare so closely with College A as did College B. No attempt was made to determine the influence of out-of-school activities or the difference in size of high school graduating classes. The influence of the social backgrounds of the individual student was not examined in this study.

The faculty members involved with both the experimental and control groups were assigned by the respective school administrations. The assignment of these teachers was made prior to the initiation of the study and it was
assumed that this represented a normal teaching assignment for each institution and was not biased by the influence of a research program. Descriptive data concerning the faculty members involved at each institution has been placed in Table III and Table IV in order for the reader to consider the influence of this variable on the students' performance.

The teachers of the control group were not prohibited the use of audiovisual presentations as a supplement to the oral technique.

Basic Assumptions

That the subjects responded honestly and to the best of their abilities on all measuring instruments was assumed. Also assumed was that the two groups selected were representative of freshman classes for colleges of similar size, philosophies, goals, and objectives.

Experimental Program

The program at College A was based on the developmental approach to education. Good (7) defined the developmental approach as a method of teaching which leads the learner to the proper conclusions by means of a step-by-step thinking process. College A has chosen this method of approach to create a situation which would facilitate the growth in total maturity of an individual without violating the freedom of the individual student. The Developmental Curriculum
was student-centered, with the developmental needs of the student helping to determine content and with the student having significant control over pace and direction. Interaction between students and faculty members emerged as a dominant factor in the students' educational experiences since the role of the faculty member was to convey meaning, to expose relationships, to synthesize concepts, and to be an example to the student. Students participating in group seminars have had the opportunity to exchange ideas with student peers, faculty, and more advanced students who acted as tutors or aides.

The importance of the developmental approach at College A was intensified by the fact that the program was being attempted with a student body that was predominantly commuter students. Commuter students have comprised a large portion of today's college enrollment and the development of instructional approaches that enrich and expand the learning experiences for these students forms a building block for future educational developments.

Austin (1) conducted a study involving the effectiveness of a formal faculty training program at College A. A faculty training program uniquely suited to College A and other institutions similar to it in philosophy and instructional practices was evaluated to determine the influence that formal training had on student attitude and personality.
Austin concluded that formal training was more beneficial than either self-training or no training at all.

Faculty training and performance was imperative under the developmental approach, since the teacher was transformed from a traditional role of information transmitter to a new role as a mature learner who guides, coaches, counsels, motivates, assists, and evaluates the student. Training programs in instructional media preparation and small group leadership techniques are offered faculty members engaged in conducting courses via the Learning Center.

The experimental method was a compilation of audio and video presentations, small or large group seminars, and directed or undirected individualized instruction. Each student had access to an audio-video carrel, the instructor, and a flexible time schedule for listening to and viewing presented material. Most of the material presented visually to the experimental group was by video tape, but the students also had access to 8mm and 16mm films, 35mm filmstrips, and audio tapes in addition to the usual library materials. Additional information was disseminated through group seminars and individual conferences with instructors.

The software used in the system consisted of some commercially prepared materials, but a large portion of the material was prepared by regular full-time faculty members at College A. In general, the structural parts for each
basic area of instruction consisted of individual learning steps, combinations of steps to form an instructional unit, and unit sequences to form a meaningful pattern of continuity. A three-hour credit course was composed of a combination of sequences to be successfully completed by the student. Generally, evaluation procedures carried out at the end of each learning step provided information which allowed a student to recycle through the learning unit or to continue to the next learning unit.

The materials developed by the faculty at College A were produced by a team consisting of faculty members from the particular discipline developing the units, graphic specialists, television production specialists, with advanced-level students majoring in the field serving as supportive personnel. Specialists outside the faculty were hired for special productions when necessary. The learning units were prepared and reviewed by the faculty team. If accepted, then the graphics were prepared for the units. The preparation team, joined by the Director of the Learning Center and the Academic Dean, conducted a final review before the units were released to the retrieval system. Academic professionals from each field were used to insure content validity, while graphic and production specialists were used to insure quality presentations.

During the three-week winter term each January, units that had been used on the retrieval system were reviewed.
and evaluated for possible minor corrections or for complete replacement. Selected students joined faculty members to review the complete set of units, the sequences of presentation, and the method of evaluation. Although the winter term served as a concentrated period of review, the review procedures were in use throughout the year.

Setting of the Study

Since the curriculum design at College A did not allow the selection of a control group at College A, the selection of a control group outside College A required that the two colleges compare as closely as possible on as many variables as possible. The selection of College B from a group of several Southwestern colleges considered was an attempt to minimize any differences between the two schools. College A was located in a major metropolitan center, whereas College B was located in a less densely populated city.

The two schools chosen for this study were located in the Southwest and during the fall semesters of 1969, 1970, and 1971 had enrollments as shown in Table XIX, Appendix. Table XX, also in the Appendix, shows comparative data for College A and College B for the fall semesters of 1969, 1970, and 1971 pertaining to the American College Testing program.

College A was an accredited, senior, coeducational, liberal arts college operating under the direction and
sponsorship of a denominational board. Totally devoted to
the use of the Learning Center as one tool for meeting the
needs of today's youth, College A provided the setting for
the experimental group. The integrating philosophy of
College A is an outgrowth of doctrines of the Christian
faith. The college has accepted the Scriptures as the
divinely inspired revelation of God to man, and from the
Christian influences has developed its concern for the
individual student and his needs. As a new senior college
on the horizon, College A has accepted the responsibility
of providing intellectual and developmental experiences
necessary for an individual to realize his potential. This
attitude has enabled the college to initiate a program with
a developmental approach via the technological assistance
of the Learning Center as a new and creative way of imple-
menting the objectives of the college. No longer can the
processes of traditional educational methods be expected to
achieve these objectives in our ever-changing technological
society.

Freedom and integrity of the individual has been
respected in the educational experiences at College A, and
the faculty has been encouraged to maintain an openness to
truth in its intellectual activities. Students of all
faiths have been welcomed and have been given the oppor-
tunities to gain a liberal education within the philosophical
framework of the college. The right of the student to think and evaluate truth for himself has been inherent to the student. The curricular objectives of College A have emphasized the individual's development, acquisition of interpersonal and professional skills, and the privileges and responsibilities of living in a democratic society. The experimental group consisted of all freshmen entering College A who had not received college credit for a course taken in residence at any institution of higher learning prior to the fall term of 1971. These freshmen were enrolled in either first-semester English or first-semester biology or both.

The control group was from College B, which was also an accredited, senior, coeducational, liberal arts college operating under the auspices of the same sectarian board. College B was charged with the purpose of encouragement, support, maintenance, and promotion of education under Christian influence. The college has reflected the belief that a broad-based liberal arts program is the best way to enable its students to receive a quality education in the sciences, humanities, aesthetics, and Christian religion. Believing that knowledge of the truth will make man free, College B has encouraged its students to seek the truth by promoting mental discipline, accurate and noble thought within the Christian concept of the dignity of man, and
freedom of the human spirit. The college has encouraged critical thinking, the acquisition of knowledge in the arts and sciences, stimulation of creative work, an adequate vocational preparation, an understanding of other people and the world, and an instillation of a deeper sense of ethical and religious views.

The control group, like the experimental group, consisted of only those entering freshmen who had not received credit for courses taken in residence at any institution of higher learning prior to the fall term of 1971. Students of the control group were enrolled in either first-semester English or first-semester biology or both.

The English courses at College A and College B were for first-semester freshman students. Each was a detailed study in basic structure of the English language, requiring frequent writing and including introductions to selected literary works.

The biology courses at College A and College B were required freshman courses and involved an introduction to the principles of the life processes of plants.

Each English course earned three hours credit and each biology course earned four hours credit. The control groups met three hours a week for English and three hours a week for biology, with the biology requiring an additional two hours weekly in laboratory work. The experimental
courses were based on learning units, and the three hours of lecture were not required to be lectures in the traditional sense. The general outline called for one hour of tape viewing, one hour in seminar, and one hour of individual conference or directed study. These three one-hour sessions soon developed into flexible schedules for each student. The biology course at College A included a two-hour weekly laboratory requirement.

**Instruments**

Four measuring instruments were used in this study. A semantic differential was used to measure attitude; the *Tennessee Self Concept Scale* was used to measure self-concept; the *Cooperative English Tests*, Form IA, was used to measure achievement in English; and the *Nelson Biology Test* was used to measure achievement in biology.

**The Semantic Differential**

The semantic differential used in this study consisted of two separate concepts, COLLEGE and THE LEARNING CENTER. Fifteen scales selected from Osgood's Thesaurus Study (14, pp. 55-61) comprised the semantic differential used in this study. These scales, bi-polar adjective pairs, were assumed to be relevant to the concepts and belonged to the three major factors in a semantic space. The evaluative adjectives were used to measure attitude, while the activity
and potency adjectives were selected to be distractors, as recommended by Osgood.

**Cooperative English Tests**

The **Cooperative English Tests**, 1960 revision, Form 1A, was a nationally standardized test designed to measure achievement of college students. The test was divided into two major sections, reading and written expression, each of which was a basic segment of the entire educational process (3).

**Nelson Biology Test**

The **Nelson Biology Test** was first published, as an achievement test, in 1950; and in 1965 form E emerged as a revision which blended the still appropriate elements with additional elements reflecting the changing content in today's biology curriculum (11).

**Tennessee Self Concept Scale**

The **Tennessee Self Concept Scale**, Clinical and Research Form, is used to measure self-concept. Developed by William Fitts, the test consisted of 100 self-descriptive statements which the subject used to portray his own picture of himself (6).

**Procedures for Collecting Data**

The basic design for data collection was the true experimental design "Number 4" as outlined in Experimental
and Quasi-Experimental Designs for Research (2). This design, entitled "The Pretest-Posttest Control Group Design," seemed to be one of the strongest designs presented in methodological literature.

Entering freshmen in the experimental and control groups were given the following instruments as pretest measures:

a. Cooperative English Tests, if enrolled in English
b. Nelson Biology Test, if enrolled in biology
c. Tennessee Self Concept Scale
d. Semantic Differential: COLLEGE.

The experimental group was given the Semantic Differential: THE LEARNING CENTER in addition to the aforementioned instruments. The pretests were given prior to the conclusion of the second week of classes. A personal data sheet was included with the pretest materials. Each group was administered a posttest on all instruments on which they took a pretest. The posttests were administered in the last week of the fall semester, 1971. All tests were administered by qualified faculty members who were familiar with the tests, testing procedures, and testing instructions.

Procedures for Analysis of Data

Data processing was performed by the Computer Center at North Texas State University. The level of significance
is reported for each hypothesis when tested in the null form.

The scales on the semantic differential instrument were assigned a number from "1" for the unfavorable to "7" for the most favorable position. Following Osgood's (14) recommendation, scores were summed over subjects and concepts, and a Pearson product-moment correlation was calculated, yielding a 15 X 15 correlation matrix of every scale with every other scale. The inter-correlation matrix was subjected to a principal axis factor analysis followed by a varimax rotation to produce a factor loading for each scale. Scales with a high loading factor in the evaluative factor were used to measure the attitude of a student toward a subject. The student's attitude score was the mean score when summed over the evaluative adjectives produced by the factor analysis.

Campbell and Stanley (2) recommended the use of analysis of covariance with pretest scores as covariates for the pretest-posttest control group design utilized in this study. Lindquist (8) recommended a two factor design where interaction might occur or where more than one variable existed. The following 2 X 2 factorial design for analysis of covariance was used for the treatment concerning hypotheses one through seven where the method of instruction and commuter-resident variable served as factors.
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CHAPTER II

RELATED LITERATURE

The attempt to evaluate an educational program involving a new or different method of instruction often has presented problems not encountered in previous research programs. One such problem occurring in this study was the attempt to define, explicitly, "Learning Center."

Literature has revealed that the words "Learning Center" refer to anything from an area in the corner of a room, stocked with paperback books, to an electronic remote access information retrieval system like that at College A.

Monson gave the following definition for a learning center in a recent symposium:

A learning center (1) has a variety of audio and visual learning paths available, (2) has both print and nonprint resources available, (3) affords opportunity for independent learning through audio and visual experiences, and (4) is integrated into the total curriculum of the instructional program (23, p. 85).

Few colleges have been free to attempt a revolutionary change in their curriculum or method of instruction. Many colleges operate under a set of traditional objectives in which the student theoretically has priority, but often little has been done to assure this priority. Nevitt
Sanford (31) proposed that colleges should not be judged by who enrolled there, but suggested that the focus be placed on what happened to a student while attending the college.

Stowe (36) suggested that the needs of the learner, the beneficiary of instruction, should determine what should be taught. The learner's prior knowledge should determine where instruction should begin and how far it should progress. The unique characteristics of the individual learner should determine how the individual should be instructed.

Individualized programmed instruction, small and large discussion groups, directed and undirected individual study, audio-visual instruction, audio-tutorial instruction, auto-tutorial instruction, and teaching machines all joined together to form a learning environment. The union of this environment with electronic media to complement the individualization has merged with a teacher-counselor and a curriculum capable of being individualized to become a learning center.

The Commission on Instructional Technology (8) submitted a report to the President and the Congress of the United States in August, 1969. The report was a study, in depth, of the present state of "instructional technology." The Commission attempted to survey the use, philosophy, advantages, and disadvantages of instructional technology and its connection with and importance to education. The
importance of technology to education evolves on the ability of technology to improve learning from the student's standpoint.

The Commission's focus on learning pointed out that most of today's education is impeded, unresponsive, and outmoded. Institutions, for the most part, are still entangled in the same lock-step sequence of time, arrangement, and space as they were twenty or more years ago. True, some innovations have arrived on the scene, but most have been discarded for lack of effectiveness or because of expense. The same course offerings in the traditional lecture-discussion classroom at the same structured time schedule have left most students desiring something more "relevant" than their ancestors desired.

Programmed instruction has helped the teacher in coping with the differences in the rate of learning and ability to learn of individual students in a heterogeneous classroom. Computer assisted instruction, individualized programmed instruction, and the use of audio and video presentations to accompany these methods of instruction have allowed educational institutions to advance toward a more modern system of education.

The Commission repeatedly emphasized the use of radio and television as media necessary for the improvement of the quality of education. An average child, by the time
he enters the classroom, has been exposed to between four and five thousand hours of radio and television ranging from cartoons, to educational programs, to the current state of world affairs. If the classroom teacher's presentation were as attractive as the normal television program, the Commission believed that the amount of material a child learned would be increased tremendously.

Instructional technology has continued to play an increasing role in today's educational fields. The move toward inter-institutional cooperative programs was evidenced in the National Science Foundation Annual Report for 1971 (24, pp. 72-73). The use of relatively inexpensive video tape recorders has advanced the possibilities of several institutions sharing in the development of material presented by an expert in any particular field.

The National Science Foundation (24, pp. 72-73) reported on an "exceptionally advanced system in instructional technology" known as the North Texas Association for Graduate Education and Research (Tager), consisting of nine educational institutions and eleven industrial receiving locations. The TAGER network, through audio-video programming, has enabled these institutions to share over 500 courses involving an enrollment in excess of 15,000 in the Dallas-Fort Worth metropolitan area (1).

Banister (2) pointed out that education will probably undergo a drastic change during the decade of the Seventies.
The taxpayers will require something in return for their money, educators will strive to measure the performance of any educational program they are responsible for administering, and the move toward competency based instructional programs will be major facets of educational change.

Banister has seen the use of instructional media as a key to the success of any change in education. Too much of the media equipment has been stored in closets because of the lack of planning on the part of the institution. The inability of most instructors to adapt to change in instructional technique, the overcrowding of educational institutions forcing the instructor to devote all of his time to current classes, without having free time to implement innovative ideas, and the lack of budgeted funds designed for curriculum development have been additional problems confronting an institution attempting to utilize a multi-media approach. Software previously available from commercial sources has often been prepared by individuals not familiar with multi-media techniques, and has generally carried a prohibitive price tag.

Banister has implied that the multi-media technique can be used effectively to achieve the goals an institution sets forth if the institution is willing to adopt a flexible schedule, provide adequate software, and plan the media system and the instructional program to complement
each other. Campuswide planning involving curriculum instruction, equipment, facilities, personnel, supplies, financing, and strategies for change must have been considered prior to any decision concerning the type of multimedia system to be installed if the system is to be effective.

The "developmental" approach to curriculum has attempted to individualize the educational opportunity of a student to such an extent that the student can enter the curriculum at his appropriate level of development and exit after completing the objectives designed for the individual. The time allotted to accomplish the objectives determined by the student with the aid of an instructor-counselor as an advisor has been part of the "developmental" approach. Few colleges have been afforded the opportunity to design and implement a curriculum that allows a student to enter at any given level of academic accomplishment and progress at his own rate throughout the entire curriculum. The development of an electronic learning center with remote access retrieval capabilities for both audio and video sources has allowed educators to think and plan in this direction. To reach the objectives of a completely individualized program, the development must have been centered around the individual and not the class or group. Each student, entering at a specific level, must have been
provided with appropriate behavioral objectives and the necessary instructional materials and guidance to accomplish the objectives (6, pp. 133-144).

The advent and use of technology to develop and construct a learning center capable of individualizing an educational program must not replace the teacher, but must serve to allow the teacher to improve the quality of education (7).

The current move toward "performance contracting" at all levels of education has allowed the institution with the ability to prepare a flexible program the opportunity to serve a community which has the desire to continue education beyond the formative years. The utilization of the facilities, equipment, faculty, and staff of an institution of higher learning for the benefit of the entire community has lessened the expense of installing any type of educational facilities. The advent of performance contracting has allowed the institution to contract with a group of people within a community or with the community itself to fulfill almost any educational objective. The instructional methods and procedures employed in teaching with the aid of an electronic learning center has closely paralleled the concept of performance contracting (5).
Learning Center

Green Mountain Junior College in Poultney, Vermont, has received recognition as having installed the first complex leading to today's learning center. The system was installed in 1944 as a language laboratory to provide extensive training in oral and aural responses (10).

The National Defense Education Act of 1958 caused a tremendous growth in the number of language laboratories. Today, almost every school, regardless of the size of enrollment, has installed some type of language laboratory. The laboratory may be only a set of audio tapes and tape recorders; nevertheless, the language laboratory has become one of the most common types of learning centers existing today. Increased technology, the projection of increased enrollments, and programs lauding the merits of language laboratories led to the learning center systems of today. Today's electronic learning center has generally employed some type of dial or remote access retrieval system (27).

Grumbling (14) conducted a survey in 1968 for the purpose of ascertaining information on Dial Access Information Retrieval Systems in the United States. The study was conducted in order to orient the faculty of Colorado State College to the present use, problems, and advantages of a dial access information system. Grumbling surveyed
128 colleges that were supposed to have had such a system in operation or that were supposed to be in operation within the year. Seven companies that design, manufacture, and install dial access information retrieval systems supplied these names. From the 128 institutions surveyed, 110 institutions replied to the questionnaire. Eighty-seven of the 110 institutions had systems in operation. There were twelve respondents that had no dial access system and one respondent that was not using the system because of faulty design and construction. Twenty-seven states had institutions with systems in operation.

The reporting institutions varied in size from 391 enrollees to 36,834 enrollees. The size of the dialing system varied from a low of only 10 dials to a high of 1,026 dial stations within the campus. The majority of the institutions had less than sixty dial stations. The University of Wisconsin allowed unlimited dial access from the normal telephone. This system was used by medical doctors on the University of Wisconsin faculty, and was accessible via any telephone in the nation. Eleven of the eighty-seven reporting institutions indicated combined capabilities of audio and video programs. These eleven institutions reported an average of thirty-three dials of this type available on their campuses (14).
Grumbling (14) reported information ranging from installation problems to the final use of the finished system. Information concerning construction, program sources, program equipment location, location of dials, air conditioning system, electrical power requirements, storage requirements, lighting, costs, and maintenance of the system among various other pertinent remarks necessary for a thorough study of a dial access information retrieval system was included in the report.

Grumbling (14, p. 153) listed several strengths of the dial access systems as reported by the various institutions. The strengths included the flexibility of the teacher-learner planning possibilities, the ability to use the system for review and reinforcement study, the individualization of instruction, the wider range of learning materials available to students, increased motivation, and the observation that students seem to learn more and learn faster.

Grumbling (14, p. 157) listed weaknesses as the lack of good teaching materials, the problem of complex equipment needing constant maintenance, the lack of teachers who can adapt to a new technique of teaching, the lack of true random access (available, but very expensive), and the lack of teacher time for effective programming and writing of materials.
Edubusiness (11) reported on the accessibility of dial access. Accessibility has improved considerably since the first installations in the mid-1960s. New items in both hardware and software areas indicated a strong future for dial access. Chester Electronic Laboratories, a subsidiary of Sylvania and part of General Telephone and Electronics, appeared to be the leading supplier of the electronic equipment for learning centers. Edubusiness estimated that there were between 250 and 300 systems in operation in the United States. Language laboratories tended to contain most of the electronic systems. Forty systems with video capabilities were reported in 1970.

Oak Park and River Forest High School in Oak Park, Illinois, received a three year grant in excess of 1.4 million dollars from the United States Government to implement an innovative educational program. A faculty committee, composed of selected faculty members, the superintendent, and chaired by the head of library services, planned the development of a remote access information retrieval system as a three stage program.

Specifications required by the study committee included complete random access to audio and video materials. The access must allow the student full control over the selection of materials. Ampex Corporation provided the equipment that most nearly met the listed requirements. The first
stage of the installation was a random access system for audio materials to twenty-five student carrels. The second stage expanded the audio availability to an additional fifty carrels and added video reception at each carrel. The proposed third stage provides random access to the video material and expands the access to area schools and to other locations on campus. The first stage was completed in the spring of 1968, and the second stage was to be completed in the 1968-69 academic year.

The Oak Park system "makes possible a more effective utilization of student and teacher time." All programs for the system are designed "to support and extend the work which teachers and students must do together." The user has full control over selection of material, the sequence of utilization, repetition of a unit, and always begins a unit at the beginning. The ability of the user to begin any unit at the beginning makes this system one of the few if not the only "true random access" system in use. One of the major complaints of the committee designing and implementing the program was that there was no software available and that publishing companies had not yet entered the field of remote access information retrieval systems (26).

McGrath (20, pp. 3-24) views the learning center of the Seventies as an instrument that will help the colleges
of this decade to maintain quality education and to keep financially out of trouble. The cost of the initial installation is far overshadowed by the extended use of such a system. Enrollment studies have indicated that the growth of college enrollments will turn drastically downward during the mid-Seventies. The learning center could be used then by the progressive and dedicated institution to attract students who would otherwise be lost to other institutions. McGrath views the tremendous potential of the learning center to individualize a student's program as one of the major strengths of such a system. Those colleges forced to lower admission standards in order to maintain current enrollment levels, but able to individualize education so that their finished products are well qualified, will survive the downward trend in student attendance and the increasing loss of government and industrial funds.

The introduction of the four day work week which increases leisure time will probably place a burden on the colleges to improve adult or continuing education programs. The ability of the dial access system to extend audio programs into the home via the telephone and to make taped material available on a time-desired basis has made the learning center a key instrument to carry out McGrath's emphasis on continuing education for the adult population. McGrath indicated that the learning center and the proper
use of such a system calls for a rededication of the teacher to teaching, the improvement of content, and a quality presentation of material.

Meierhenry (21, pp. 49-52) suggested five ways of integrating the learning center into the curriculum of today's schools. The methods ranged from installing the technology and then finding a way to use the system to a cooperative approach between faculty and administration of developing objectives and material and installing the technology compatible with the goals and objectives of the institution. The latter method tends to produce better results from the finished product.

Oklahoma Christian College, Oklahoma City, "on the creative edge of American higher education," opened what was probably the first wholly electronic learning center system. Gunselman has described this system as "an excellent place to do traditional types of study." Oklahoma Christian College has provided both local and international study opportunities to the student body through the use of approximately 1,440 carrels. Faculty comments have indicated a total commitment to the "learning center" method of instruction. Students, alumni, and institutional constituents voiced similar opinions of the educational values of the learning center program at Oklahoma Christian College. Gunselman attributed the general increase in the
Graduate Record Examination test scores to the improvement of the educational environment at the college and not to specific detailed areas (16, pp. 157-165).

In 1965 Oral Roberts University, Tulsa, Oklahoma, opened a learning center involving the use of video dial access. The multipurpose learning center, contained in a six-story complex, was labeled the "academic hub" of the campus. The center served approximately 300 freshman students initially and was part of a twenty million dollar investment. Six years of experience by the faculty and administration caused William Jernigan, Director of Learning Resources, to conclude that "electronic media will never take the place of a quality book collection—the traditional library and the new electronic media should work hand-in-glove." Jernigan indicated that versatility, economics, and ease of editing a tape-slide presentation resulted in video tape being used only when animation was an absolute necessity (19, pp. 167-169).

Brigham Young University, Provo, Utah, combined several areas of the University into one unit called the Communication Services Division. This division began functioning in 1965 and, at this time, through the services of a learning center incorporating both dial and touch-tone access, served probably the largest student body in private education. The 25,000 daytime students have used much of
the most modern instructional equipment available with a large variety of instructional techniques employed by the various divisions of the University. Brigham Young University has had audio access and video access positions at various locations both on campus and in the general area around the campus. Both video playback systems and programmed texts have been widely used in the instructional techniques at the institution. New modes of instruction have been developed, evaluated, and either discarded or placed into practice by the faculty and students of Brigham Young University (22, pp. 177-182).

Langston University is a predominately black, state supported institution in central Oklahoma. The 1,200 students enrolled at the college have been served by a learning center consisting of 116 carrels equipped with dial access to audio programs. The students entering Langston have come from diverse backgrounds. The institution has attempted to alleviate the effects of cultural and intellectual development, so often prevalent in an underprivileged environment, through the use of the learning center. Programmed instructional material designed to meet the needs of the individual student, accompanied by audio tapes, have formed the core of the instructional program at Langston University (9, pp. 183-187).
Western Michigan University, Kalamazoo, with an enrollment of approximately 21,700 has considered its primary objective to be teacher preparation. Western claims that over the past several years more teacher candidates from Western have entered the teaching profession than from any other institution in the country. Western Michigan's Educational Resource Center was designed to be a "center for all the resources in education." The Center, located in Gangren Hall, has served the entire educational community of Western Michigan through its data storage areas and several "dry" carrels designed for study areas. The program has included a self-taught audiovisual equipment laboratory. Student teachers have had access to media support material and have had check-out privileges during their tenure as student-teachers in the area classrooms (32, pp. 195-198).

Software

Monson (23, pp. 85-108) has divided software into three areas: (a) audio-video types, (b) recorded audio materials, and (c) slide sets, overhead transparency sets, models, pictures, and material objects. Monson has predicted that within a few years an audio cassette player will be as common at Brigham Young University as a textbook is today.
Software has apparently been a major problem. Oak Park personnel believed that vandalism in the carrels would be lessened if the programs were more interesting. Oak Park has tried to improve programs by creating enthusiasm for the teachers. At present only ten per cent of the teachers have been actively involved with the program. Ted Johnson stated, "These companies should talk to teachers BEFORE they make up a program, not when they've got one to sell" (11, p. 2).

West Hartford, Connecticut, Public Schools planned to extend beyond the confines of the walls of the high school in installing a dial access system. Ira Singer, head of the school, has planned access stations for laundromats, museums, and other external sites on a regional network basis (11, p. 2).

Stanfield (35, pp. 171-174) indicated that the biggest problem of the Instructional Methods Division at Fort Benning, Georgia, was that of software. The coming of "Volar," all-voluntary army, necessitated the move to eliminate all nonessential activities of the Armed Forces. The learning center at Fort Benning began with the use of Edex student response machines and cathode ray tubes for computer assisted instruction. The system has now expanded as a pilot project to include thirty carrels using slide projectors and audio cassette players and four carrels with
color television sets. The objective of this installation was to train the American soldier to become one of the "world's finest combat leaders."

Achievement

Achievement, probably one of the most "measured" aspects of educational evaluation, has generally served as one means of determining the success or failure of any particular educational program.

The additional reinforcement a student received when working on a short programmed study unit was of extreme importance. Taber et al. (38) stated that immediate reinforcement will cause the student to concentrate more effectively. Wallen and Travers (39, pp. 494-495) articulated six principles of learning, with the first stating that achievement of an educational objective represented by behavior should be reinforced.

S. N. Postlethwait, sometimes referred to as the pioneer of the learning center approach in science, conducted one of the first experimental studies involving the learning center approach. Postlethwait (29) placed slide projectors and audio tape players in the biology laboratories at Purdue University. No significant difference was found in the achievement levels of biology students under the learning center approach when compared with the traditional lecture-discussion approach. Postlethwait did
find that the learning center approach required less time from the student, than the lecture-discussion method, in order to receive a comparable grade.

Russell (30) compared an audio-tutorial approach with a traditional approach in biology. The study involved the Dallas County Junior College District, El Centro Campus, and the South Campus of the Tarrant County Junior College District. Freshman biology students of the two campuses were involved in the study. The Dallas campus served as the experimental group using the audio-tutorial approach.

Russell examined the effect of a "third-generation" program of presenting biology through the audio-tutorial method. The removal of problem areas or trouble spots faced by the researchers between Postlethwait and Russell prompted Russell to examine the efficiency of an audio-tutorial method versus a more conventional method.

Russell (30, pp. 97-100) found that overall achievement favored the conventional program, but that when the subjects were divided into groups using the ACT composite scores there was no significant difference. The control group and the experimental group did not differ significantly in attitude toward biology. Russell recommended that additional studies be carried out with emphasis on the ability level of the student, time involvement of the student, and the internal functioning of the audio-tutorial system itself.
The biology department at Golden West College, Huntington Beach, California, made extensive use of a variety of instructional materials. Videotape, motion pictures, audio tapes, slides, and other audio-visual devices have aided the instructors in implementing the curriculum. General Assembly sessions of approximately 400 students met every Monday during the semester to receive motivational lectures, view films, listen to guest speakers, or to receive a final examination. The students scheduled themselves into the laboratory following this general assembly session. The laboratory was open thirty-seven hours per week on a first-come first-served basis. The course was designed around behavioral objectives of the Mager format and contained a learning evaluation aspect also. The students received short quizzes once each week over the material covered in the last five days. There was an hour quiz given every four to five weeks. The weekly quizzes were graded immediately and returned to the students with the questions keyed to indicate to which behavioral objective the questions were supposed to relate. The evaluation program was tied closely to the behavioral objectives of the course and gave a continuous item analysis to the professors. The item analysis was used to revise the tests or learning units. A time clock used by the students gave an hour evaluation of the time the student spent in the
laboratory. The time factor was used to adjust the amount of material required to be completed in the course when the time exceeded the credit justification for the course. The instructors found several advantages to the auto-tutorial approach which was patterned closely after that used by Postlethwait at Purdue in 1962. Advantages included the ability to repeat materials not understood, being able to work at one's own pace, making up material missed when absent, and the availability of a tutor (2, pp. 42-45).

The English faculty at Golden West College worked on the premise that "students can be taught principles and concepts of spelling, grammar, punctuation, and sentence structure to be applied to subsequent writing situations" (2, p. 47). Sixty to seventy per cent of the students entering freshman English were found to be deficient in English and in need of remedial work before they could successfully complete the freshman composition course. The need for remedial work presented several problems. One concerned the selection of teachers for remedial work, since most of the instructors preferred to teach literature rather than composition, spelling, and grammar. An auto-tutorial approach was chosen in an attempt to alleviate this problem. English A, a nine week course concentrating on spelling, grammar, punctuation, and sentence structure, met four hours a week in large group sessions. English B,
a nine week course dealing primarily with paragraph writing, met in small group sessions. Frequent tests were administered in English A, and a student could progress beyond English B by writing a paragraph on a designated topic and receiving a passing grade before beginning the course. The English instructors believed that the courses were accomplishing their purposes since those students completing English A were more likely to succeed and usually to receive better grades in advanced classes than those students who did not complete English A (2, pp. 45-47).

The mathematics department at Fullerton Junior College, Fullerton, California, taught selected pre-calculus courses by a multi-media instructional system. Six instructors participated in the development of the curriculum and the multi-media units produced for each course. Each course consisted of approximately thirty-five auto-tutorial lessons. The instructors worked in teams to write the different units. The courses consisted of various combinations of filmstrips, tapes, worksheets, seminars, and quiz lessons. Students spent three hours a week in class and about two hours in the laboratory. New concepts were presented by tape and the class sessions were not to be used as lecture periods. The only self-pacing aspect in this program was the student's scheduling of his laboratory time. Each student had to complete specified materials by a certain
date since all quizzes were given on designated dates. Class meetings were designed for administering quizzes, answering questions, and providing motivational introductions to the next unit.

Evaluative comparisons of the auto-tutorial technique with the traditional system did not show superiority of either method for the total program. The auto-tutorial system showed superior results where there was a difference. A lower attrition rate, favorable reception by the students, and the usefulness of the material for review and independent study by advanced mathematics students provided the Fullerton Junior College Mathematics Department with incentive to continue the program and to develop additional materials (2, pp. 40-42).

Hansen, Dick, and Lippert (17) reported that students registered at Florida State University for a college physics course using a multi-media approach, including audio and video materials in connection with a computer response system, performed significantly better than those students enrolled in the conventional course. The instructional materials were designed for self-paced instruction and made extensive use of computer assisted instructional materials. Florida State has extended the science course offerings to area seventh and eighth grades and has added auto-tutorial assistance in reading and mathematics.
The business education department at Mt. San Jacinto College, Gilman Hot Springs, California, has been teaching typing and shorthand using a multi-media approach for three years. The taped lessons have replaced the instructor for nonteaching duties and have allowed the instructor to concentrate on the individual student instead of classroom instruction. All timed tests, direction giving, and dictation were given through audio tapes. The teacher was free to watch the technique of the individual student and to give assistance to anyone needing help or individualized instruction. The classes consisted of beginning, intermediate, and advanced students all scheduled at the same time. The students were responsible for meeting the minimal performance levels outlined in the behavioral objectives for each lesson. The business education professors have been developing additional systems to use for other courses (2, pp. 38-40).

Stuck and Manatt (37, pp. 414-416) conducted a comparative study at Iowa State University to determine if concepts of school law could be effectively taught using auto-tutorial methods for preservice teachers. The study involved 219 senior students enrolled during the quarter of this experiment. The students were randomly assigned to experimental auto-tutorial sections and to the traditional lecture-discussion classes. The traditional group was given
seven hours of formal instruction while the auto-tutorial group was given one week to complete the materials. Time records were kept by the individual students in both the traditional and the experimental sections. At the conclusion of the experiment posttests were administered, and a retention test was given three weeks later. The experimental group showed a significantly greater increase in achievement than did the traditional group. The traditional group spent 38.44 per cent more time on the unit than did the experimental group and still scored significantly lower on the achievement level. Stuck and Manatt concluded that the experimental group could have achieved at an even greater level of significance had there been a tutor available in the auto-tutorial instruction room.

Attitude

Cassel (3, pp. 10-13) developed a semantic differential to measure the attitude of high school and college students toward three concepts: "teacher," "learning," and "student." Cassel used thirty-five bi-polar adjective pairs and a seven point Likert-type scale. Kuder-Richardson Formula 20 was used to determine internal reliability coefficients which ranged from $r = .928$ to $.960$. Cassel concluded that there was evidence of greater homogeneity for post-course attitude evaluations than for pre-course evaluation. Factor analysis run on the data
determined the factor content of the semantic scales that Osgood listed as scales in a semantic space (3, p. 12; 28).

One phase of an evaluation conducted at Fullerton Junior College by the mathematics department in auto-tutorial pre-calculus mathematics classes involved the administration of a twenty-six item attitude survey administered to 125 students enrolled in the second year of the program. Many students initially tended to fear and dislike mathematics. A number of the auto-tutorial students increased their self-confidence and were willing to take an additional mathematics course, if it were an auto-tutorial course and not a traditional course. Many auto-tutorial students liked the auto-tutorial methods from the beginning and thought that the benefits of being able to stop and repeat the material, the attendance at the laboratory at their convenience, the periodic self-mastery tests, and the small-group seminars were distinct advantages of the auto-tutorial system over the more traditional lecture method (2, pp. 41-42).

Cost of Instructional Technology

Evaluation of any type of system, educational or non-educational, must of necessity involve a measure of accountability. In attempting to measure accountability, one major factor to consider has been the cost of any system as related to the capability of the system to improve learning.
The Commission on Instructional Technology noted that student learning was the heart of education and that any attempt to evaluate a system must also evaluate the extent to which learning takes place (8).

Numerous research reports have been made concerning individual programmed instruction, audio-tutorial processes, use of audio-visual presentation, visual presentations, closed circuit television, and many other component parts that make up a learning center. The Director of the Learning Center at College A was unaware of research reports on the learning center as a total entity.

The Commission on Instructional Technology (8, p. 36) reported, "the TV advertising budget for a fifty-second commercial selling a headache tablet is larger than the annual budget for public television." Recommendations to the President of the United States by the Commission included one suggesting that the nation should increase its investment in instructional technology in order to upgrade the quality of education and consequently the quality of the social and cultural lives of individual citizens. The commission listed several contributory factors to the high cost of instructional technology which included such items as complex equipment, developing and testing high quality programs, released time for teachers, costs of media specialists, and the cost of equipment maintenance (8).
Sloan (34) compared the cost of automated instruction with traditional instruction at Fairleigh Dickinson University in New Jersey. Formulas developed by Sloan expressed the cost of instruction as an "instructional cost index" figure. The index included as variables the faculty members' salary, teaching load per week, hours devoted to class per week, tuition per credit hour, number of students in the course, and credit hours for the course. The index for the automated instructional program included these variables in addition to the cost of one machine per year, total machine use in hours per week, machine use in hours devoted to the course in question, and the number of machines used for the course. The index is computed for each section of a course in question. Sloan found the instructional index for automated instruction to be about forty per cent less than the instructional index for conventional instruction. Sloan suggested that colleges attempt to decrease instructional costs, while maintaining quality, instead of increasing tuition, since tuition at private colleges and universities has increased at more than twice the rate of increase for the consumer price index over the past decade.

Gunselman (15, pp. 121-128) discussed the cost of a learning center and the feasibility of such a center for instructional purposes. In a recent study conducted by the
Oklahoma Regents for Higher Education, Oklahoma Christian College reported the lowest cost per credit hour taught for freshman and sophomore courses of all institutions of higher education in the state of Oklahoma. Oklahoma Christian College used a dial access system containing 870 carrels, but with audio access only (27).

Gunselman (15, pp. 121-128) claimed that the cost of building and equipping a learning center was comparable to the cost of a science building and the necessary laboratory equipment for such a building. Major factors to consider in construction and cost of a learning center have involved the objectives of the center and what an institution proposed to accomplish with the center. Maintenance costs have been estimated to run about ten to fifteen per cent of the original cost of the equipment. Audio dial access has been considered feasible when more than 200 students use the system, but it has been difficult to justify the installation expense of video dial access. The use of master antenna television systems has appeared to be more appropriate. Gunselman concluded, "on the basis of cost, the learning center concept can be feasible by almost any institution if used wisely and can be afforded on the same basis as any other well-equipped facility" (15, p. 128).

Stafford North (25, p. 64) reported from a study conducted by the Academy for Educational Development that the
cost of teaching one English course at Oklahoma Christian College using a media assist approach had a rating of .145 as compared with a rating of .336 when taught without the assistance of the media support. These numbers were ratings only and did not convert directly to dollars and cents. The conclusions offered by North indicated that the cost of a course taught through the media support approach at Oklahoma Christian College was about one-third the cost of a traditional course. These figures included only the operational costs and not the initial expense of the equipment and installation.

Meramec Community College, Kirkwood, Missouri, conducted an experimental program in self-directed learning with twenty-eight selected students in the spring semester of 1970. Fifteen of the students finished the course with a grade of A, while five received a B, one received a C, five were reported incomplete, and two students withdrew from the program. The grade point average for the students was 3.66, which was significantly higher than for students enrolled in other college courses. The cost expenditure was calculated to be approximately twelve dollars per student credit hour, which was the same cost per student credit hour as the direct instructional method. Hunter concluded in the report that although the cost of self-directed learning was about the same as the traditional
direct instruction cost, the increased learning indicated by the higher grades and the increased use of facilities justified the continuation and enlargement of the program at Meramec in the fall semester of 1971 (18, pp. 147-154).

Self-Concept

Mauzafer Sherif (33, pp. 150-159) has considered study and research related to a person's self-concept or self-ego to be of utmost importance in today's changing society. The relationship of an individual with his reference groups from birth till death has influenced self-concept. The individual began life by relating his "self" to that area which was around him and to the more sensory concepts of hunger, sleep, and pain. The adolescent began to associate with reference groups at school, at home, at play, and at church. These reference groups have had a tremendous effect on an individual's self-concept. Education has tended to revise the amount of free time that an individual has had to associate with his reference groups. Self-concept has tended to be the product of interaction of the individual's physical and social environment from infancy onward. This interaction has involved the individual's attitude toward the reference groups of his association, the teachings he receives, his attitude toward the institutions of society, and the interrelation of these different aspects. Changing attitudes that form a part of the
person's self and his relationship to those around him have altered society. To change this attitude in such a way that society will benefit from the change has been one goal of education.

Furr (13) claimed self-concept to be one of the most important concepts in the field of education. The stability and change of the self-concept of a person have been affected by changes in age and experience of the individual. Change in self-concept has been brought about as a result of a change in the perspective of an event. The influence of an educational system has served as the factor that changes a person's self-concept. The method of instruction, the teacher's presentation, the course involved, the relationship of the individual with his peers, and the ability of a method of instruction to promote a change all have served to influence the self-concept of the individual student.

Combs (4) suggested that self-concept was directly influenced by a direct provision of a specified event. The careful planning and designing of a curriculum totally devoted to serving the student could have profound influence upon the individual's self-concept. Other factors of importance could be the training of teachers and the careful selection of materials to be covered in a particular course of instruction.
Recent years have shown wide and varied attempts to measure the self-concept of an individual's behavior. Self-concept has been shown to be a major factor related to the general personality and mental health of any individual. Knowledge of how an individual perceives himself both before and after an experience involving a method of teaching selected material to an individual could provide important data necessary in making a decision as to whether a method of teaching should be continued, refined, or discarded (12).
CHAPTER BIBLIOGRAPHY


7. ____________, unpublished paper read before the Texas Association Educational Technology, Austin, Texas, November 9, 1970.


CHAPTER III

EXPERIMENTAL PROCEDURES

Description of the Sample

This study was conducted in two liberal arts colleges in the Southwest, College A, the experimental group, and College B, the control group. English and biology provided the curricular media on which the study was based. Freshmen enrolled in the fall of 1971 without previous college credit provided the subjects studied for the research program. Students enrolled in the first-semester English and biology courses were asked to complete a "Personal Data" sheet. The information obtained from these sheets is presented in Table I.

Data shown in this table consist of the number and percentages of certain descriptive items: sex, age, marital status, and resident or commuter classification. The number of students reported in this table differs from the number of students reported in Table XIX, Appendix. This table consists of only those students who were used in at least one aspect of this study. The number of students enrolled and the sex breakdown in the appendix table includes all freshmen enrolled at either College A or College B. The
categorical breakdown for age has shown that both schools had students of comparable ages. The difference between the percentages of resident and commuter students at the two institutions has underscored the need for the resident-commuter factor as one dimension in the research design and analysis.

TABLE I
PERSONAL DATA ON FRESHMEN AT COLLEGE A AND COLLEGE B, FALL, 1971

<table>
<thead>
<tr>
<th>Personal Data</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freshmen</td>
<td>Per Cent</td>
</tr>
<tr>
<td>Male</td>
<td>111</td>
<td>50.4</td>
</tr>
<tr>
<td>Female</td>
<td>109</td>
<td>49.6</td>
</tr>
<tr>
<td>18 or under</td>
<td>149</td>
<td>67.7</td>
</tr>
<tr>
<td>19-20</td>
<td>52</td>
<td>23.6</td>
</tr>
<tr>
<td>21-22</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>23-24</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>25-26</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>Over 26</td>
<td>13</td>
<td>6.0</td>
</tr>
<tr>
<td>Single</td>
<td>200</td>
<td>90.9</td>
</tr>
<tr>
<td>Married</td>
<td>20</td>
<td>9.1</td>
</tr>
<tr>
<td>Resident student</td>
<td>97</td>
<td>44.1</td>
</tr>
<tr>
<td>Commuter student</td>
<td>123</td>
<td>56.0</td>
</tr>
</tbody>
</table>
Table II compares the size of the high school graduating classes of the freshman students and the academic rank of the students within their respective classes.

**TABLE II**

**SIZE OF HIGH SCHOOL GRADUATING CLASS AND CLASS RANK OF FRESHMEN AT COLLEGE A AND COLLEGE B, FALL, 1971**

<table>
<thead>
<tr>
<th>Class</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per Cent</td>
</tr>
<tr>
<td>Less than 100</td>
<td>25</td>
<td>11.36</td>
</tr>
<tr>
<td>100-199</td>
<td>17</td>
<td>7.73</td>
</tr>
<tr>
<td>200-299</td>
<td>22</td>
<td>10.00</td>
</tr>
<tr>
<td>300-399</td>
<td>21</td>
<td>9.55</td>
</tr>
<tr>
<td>400-499</td>
<td>21</td>
<td>9.55</td>
</tr>
<tr>
<td>500-599</td>
<td>30</td>
<td>13.64</td>
</tr>
<tr>
<td>600-699</td>
<td>23</td>
<td>10.45</td>
</tr>
<tr>
<td>700-799</td>
<td>32</td>
<td>14.55</td>
</tr>
<tr>
<td>800 or above</td>
<td>27</td>
<td>12.27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Quarter</td>
<td>29.55</td>
</tr>
<tr>
<td></td>
<td>2nd Quarter</td>
<td>35.91</td>
</tr>
<tr>
<td></td>
<td>3rd Quarter</td>
<td>26.36</td>
</tr>
<tr>
<td></td>
<td>4th Quarter</td>
<td>4.55</td>
</tr>
</tbody>
</table>
Data displayed in Tables I and II have been presented to enable the reader to compare the two colleges. The resident-commuter factor was the only factor from this descriptive data used as a variable in the analysis of data.

Description of Teachers

Table III presents descriptive data pertaining to each teacher involved in an English class. One teacher at College B holds less than a master's degree. The average age of the teachers at College A was 52.2 years, whereas at College B the average age was 41.7.

The mean for teaching experience for teachers of English at College A, 7.5 years, was somewhat misleading since College A changed locations in 1965 and enrollment increased from about 100 to about 1,000. Thus, most teachers joined the faculty after 1965. The mean teaching experience at College B was 5.6 years, with four members having less than three years experience at College B. The mean for total teaching experience for the faculty members at College A was 12.6 years. The mean for total teaching experience for the faculty members at College B was 11.5 years. One teacher at College A had almost equivalent longevity at each of the two colleges.

One factor not shown in the table was the nine-month salary schedule for each teacher. The mean nine-month salary was $9,365 at College A and $8,828 at College B.
TABLE III

DESCRIPTIVE DATA PERTAINING TO ENGLISH INSTRUCTORS
AT COLLEGE A AND COLLEGE B

<table>
<thead>
<tr>
<th>Instructors</th>
<th>Sex</th>
<th>Age</th>
<th>Marital Status</th>
<th>Academic Rank</th>
<th>Highest Degree</th>
<th>Hours Beyond Highest Degree</th>
<th>Teaching Experience at College A (years)</th>
<th>Teaching Experience at College B (years)</th>
<th>Teaching Experience Elsewhere (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>F</td>
<td>67</td>
<td>M</td>
<td>Asst. Prof.</td>
<td>M.Ed.</td>
<td>10 s.h.</td>
<td>21</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>57</td>
<td>S</td>
<td>Assoc. Prof.</td>
<td>M.A.</td>
<td>57 q.h.</td>
<td>3</td>
<td>2½</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>60</td>
<td>M</td>
<td>Asst. Prof.</td>
<td>M.Ed.</td>
<td>15 s.h.</td>
<td>5</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>25</td>
<td>M</td>
<td>Inst. Prof.</td>
<td>M.A.</td>
<td>6 s.h.</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>College B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M</td>
<td>32</td>
<td>M</td>
<td>Asst. Prof.</td>
<td>M.A.</td>
<td>9 s.h.</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>43</td>
<td>D</td>
<td>Assoc. Prof.</td>
<td>M.A.</td>
<td>33 s.h.</td>
<td>0</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>43</td>
<td>M</td>
<td>Asst. Prof.</td>
<td>M.A.</td>
<td>None</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>50</td>
<td>S</td>
<td>Asst. Prof.</td>
<td>B.J.</td>
<td>24 s.h.</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>60</td>
<td>M</td>
<td>Prof.</td>
<td>M.A.</td>
<td>8 s.h.</td>
<td>0</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>29</td>
<td>M</td>
<td>Assoc. Prof.</td>
<td>*</td>
<td>*</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>34</td>
<td>M</td>
<td>Prof.</td>
<td>Ph.D.</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

Table IV presents descriptive data for the biology teachers at each of the two colleges. The average age for those teachers at College A was 42.8 years. The average age at College B was 37.5 years.

**TABLE IV**

DESCRIPTIVE DATA PERTAINING TO BIOLOGY INSTRUCTORS AT COLLEGE A AND COLLEGE B

<table>
<thead>
<tr>
<th>Instructors</th>
<th>Sex</th>
<th>Age</th>
<th>Marital Status</th>
<th>Academic Rank</th>
<th>Highest Degree</th>
<th>Hours Beyond Highest Degree</th>
<th>Teaching Experience at College A (years)</th>
<th>Teaching Experience at College B (years)</th>
<th>Teaching Experience Elsewhere (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>College A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>F</td>
<td>36</td>
<td>M</td>
<td>Assoc. Prof.</td>
<td>Ph.D.</td>
<td></td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>46</td>
<td>M</td>
<td>Assoc. Prof.</td>
<td>Ph.D.</td>
<td></td>
<td>11</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>47</td>
<td>M</td>
<td>Prof.</td>
<td>Ph.D.</td>
<td></td>
<td>5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>42</td>
<td>M</td>
<td>Prof.</td>
<td>Ph.D.</td>
<td></td>
<td>3</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>College B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M</td>
<td>35</td>
<td>M</td>
<td>Assoc. Prof.</td>
<td>Ph.D.</td>
<td></td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>40</td>
<td>M</td>
<td>Assoc. Prof.</td>
<td>M.A.</td>
<td></td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>
One faculty member at College B did not have an earned doctorate but had sixty-six semester hours beyond the master's degree. The average teaching experience for instructors was 4.5 years at College A and 2.0 years at College B. The total teaching experience for biology teachers averaged 14.2 years at College A and 10.5 years at College B.

The mean salary for the biology faculty at College A was $12,165 for nine months. The average salary at College B for the same period of time was $10,794.

College A had one faculty member who has accumulated two more years' experience at College B than at College A, his present location.

No attempt has been made to equate or distinguish between the abilities or quality of teaching of the individual faculty members. The teachers at College A were not compared to the teachers at College B other than by the descriptive data given in the tables. There were no comparisons made between English and biology teachers at either College A or College B.

Instrumentation

The four measuring instruments selected for this study included the Cooperative English Tests, Nelson Biology Test, Tennessee Self Concept Scale, and the semantic differential technique.
Cooperative English Tests

The Cooperative English Tests, 1960 revision, Form 1A, was designed to measure achievement at the college freshman level. The test consists of two sections, Reading Comprehension and English Expression, with each section requiring forty minutes for administration.

Feldt (3, pp. 552-554) claimed the test was well-constructed and should prove useful within certain cited limitations. The limitations involved a false notion of confidence interval and the interpretation of class performance. Feldt criticized the lack of a measurement of the student's ability to select a phraseology more appropriate to a certain kind of writing. Since the subjects in this study were evaluated with respect to total score performance, not class performance, these criticisms were of no consequence for this study.

Lorimer (7, pp. 554-556) said the test was probably among the best on the market, while Siegel (11, p. 556) considered the test to be "truly outstanding." Sherwood (10, p. 556) claimed the most obvious merit of the test to be the efficiency of a combination of time and relatively good coverage of different aspects of English expression and composition.
The *Nelson Biology Test*, Form E, was constructed to measure important educational objectives attained by a student in a biology course. Form E emerged as a revision of the 1950 edition after the *Biological Sciences Curriculum Study* program designed new conceptual schemes and pattern concepts for presenting biology. The revised edition published in 1965 was a blending of the still appropriate elements with added elements to reflect the changing content of biology courses.

The appropriateness of each objective and topic measured was determined with respect to the amount of time given to that topic in various textbooks, recommendations by notable experts in the field, and pronouncements of national and state committees. Item-tryout and standardization procedures were followed very carefully in a well-supervised program. The selection of questions by experts in the field of scientific education served as a validity check for the program. Two experimental forms of 116 items each were administered to 7,125 biology students in 27 public high schools from 21 states. The *Otis Mental Ability Tests: Gamma Test*, Form Fm was administered at the same time to serve as an estimate of mental ability levels of the various testing groups. All teachers were asked to criticize the test and evaluate each item with respect to five topics.
The experimental forms were reorganized into two equivalent forms, E and F, with sixty-five items each. Rescoring and correlation of the short forms with the long form approximated a correlation coefficient of .98 (8).

Horton (5, pp. 625-627), reviewing an earlier form, maintained that the test was very good for its purpose. Questions were unusually good, coverage was good, and only a few items were open to criticism. Johnson (6, p. 627) asserted that both forms were well-adjusted for coverage, and that the test should be an asset as a measuring instrument. In fact, Johnson claimed that only two items could be questioned at all, and that validity and reliability factors were unquestionably good.

Knowledge, comprehension, and application, three cognitive areas, were considered in the revised test. The Nelson Biology Test had a unique "DK," "don't know," choice for each answer. Therefore, contamination by wild guessing was decreased (8).

The Tennessee Self Concept Scale was designed by William H. Fitts of the Tennessee Department of Mental Health to measure self-concept. The author began the development of a scale in 1955, resulting in this measurement, which is simple for the subject, widely applicable, and well standardized. The
scale, consisting of 100 self-descriptive statements and
self-administering for individuals or groups, could be used
with subjects with an educational background at least as
great as that of an average twelve year old.

The test-retest reliability coefficients for all major
scales ranged from a low of .60 on the "D" score to a high
of .92 on the "Total Positive" score. Four types of valida-
tion have been reported by Fitts: (a) content validity,
(b) discrimination between groups, (c) correlation with
other personality measures, and (d) personality changes
under particular conditions.

The "Total Positive" score reflected the overall level
of self-esteem of the subject and was considered the most
important single score on the scale. To be judged as having
a positive self-concept, the subject must have a "Total
Positive" score above the mean. The "Total Positive" score
was the score used as the measure of self-concept for this
study (4).

The Semantic Differential

The semantic differential technique developed by
Charles E. Osgood was used to measure student attitude
toward COLLEGE and THE LEARNING CENTER. This technique
has become increasingly popular since its inception during
the late forties and early fifties (1).
Osgood (9, pp. 193-194) compared the semantic differential with Thurston scales on three concepts (The Negro, The Church, and Capital Punishment). Correction of the six validity coefficients for attenuation raised each factor to the .90 level or better. Thus, Osgood concluded, "... whatever the Thurston scales measure, the evaluative factors of the semantic differential measure just about as well."

Fifteen scales selected from Osgood's Thesaurus Study (9, pp. 53-61) comprised the semantic differentials used in this study. Ten of these adjective pairs were listed as evaluation adjectives: good-bad, complete-incomplete, graceful-awkward, pleasurable-painful, successful-unsuccessful, meaningful-meaningless, important-unimportant, positive-negative, reputable-disreputable, and wise-foolish. Two pairs were listed as potency adjectives: hard-soft and severe-lenient. Three pairs were listed as activity adjectives: active-passive, complex-simple, and motivated-aimless. These scales were assumed to be relevant to the concepts measured, and each scale belonged to one of the three major factors in a semantic space. The selection of activity and potency adjective pairs as distractors was recommended by Osgood. Each scale consisted of a seven-step continuum, and the scale positions were defined in the instructions to each student. The format followed Osgood's Form II (9, pp. 82-84).
Experimental Design and Collection of Data

Pretests and posttests were administered to each section of first-semester English and biology at College A and College B in the areas of achievement, self-concept, and attitude. This testing complied with the requirements of the experimental design referred to by Campbell and Stanley (2, pp. 13-25) as "The Pretest-Posttest Control Group Design." The design, one of three true experimental designs, controls for several sources of invalidity outlined by Campbell and Stanley (2, p. 8).

English, biology, self-concept, and attitude pretests were administered during the first two weeks of the fall semester. Total time required for the administration of all pretest data approximated three hours. Each school was allowed to arrange the pretest sessions to fit its schedule as long as the testing was completed during the first two weeks and prior to the beginning of formal instruction in the discipline. Laboratory sessions or classroom sessions served as testing periods. All make-up tests were administered during the first two weeks.

The posttests were administered during the last week of the semester and prior to the beginning of the final examination period at each school. College A and College B both finished the fall semester prior to the Christmas recess. Therefore, no attempt was made to administer
make-up tests on the posttests. The time allotment for administration of posttests was the same as for the pretests.

The Tennessee Self Concept Scale and the semantic differentials were administered to both English and biology students. If two copies of the same pretest or posttest were completed by a student, the instrument completed at the earliest date was used in the study and the other copy was deleted.

The registrar's office at each college provided data concerning the ACT test scores of the freshmen. Sixty-one subjects at College A and eighty-three subjects at College B were dropped because of incomplete or missing ACT scores.

The subjects completed a "Personal Data" sheet at both pretest and posttest administrations of the semantic differential. If there were any discrepancies between the two instruments that could not be reconciled from records provided by the registrar's office, then these students were dropped from the study. This resulted in fifteen students being dropped, primarily because they had previously been enrolled in college.

In addition to the above loss, scores on all pretest and posttest instruments were not available for a number of students. Absences, late enrollments, failure of one biology faculty member at College A to administer one posttest, and the failure of three faculty members at College B
to administer the English pretest caused some scores to be unavailable on selected instruments. These students were not dropped completely from the study. Scores were used where the complete data required for a specific test was available. Statistical analysis thus includes the subject where complete data was available for that hypothesis and statistical test. Consequently, the computer print-out contained different N's for different hypotheses.

Procedure for Analysis of Data

Data processing was performed by the Data Processing Center at North Texas State University utilizing an IBM 360 model 50 computer. The program for 2 X 2 analysis of covariance with unequal and disproportionate cell frequencies was written under the direction of Frank Walker, programmer for the Center, and followed the model and recommendations of Winer (12). All other programs were available through the Center's statistical library.

The level of significance is reported for each hypothesis when tested in the null form in order that the reader might see the calculated level of significance.

In the remainder of this chapter individual hypotheses will be referred to by number. A complete statement of each hypothesis can be found in Chapter I and Chapter IV. All hypotheses were restated in the null form for testing purposes.
The experimental-control grouping and the resident-commuter grouping served as the two factors in a 2 X 2 factorial design employed for analysis of covariance as illustrated in Chapter I.

Achievement

Hypotheses 1<sub>a</sub>, 2<sub>a</sub>, 3<sub>a</sub>, 4<sub>a</sub>, and 5<sub>a</sub> were tested by performing 2 X 2 analysis of covariance with unequal and disproportionate cell frequencies with the ACT English score and pretest scores from the Cooperative English Tests, Tennessee Self Concept Scale, and attitude toward COLLEGE serving as covariates. The criterion variable was the posttest score on the Cooperative English Tests.

Hypotheses 1<sub>b</sub>, 2<sub>b</sub>, 3<sub>b</sub>, 4<sub>b</sub>, and 5<sub>b</sub> were tested by the same procedure, but with the ACT Natural Science score and pretest scores from the Nelson Biology Test, Tennessee Self Concept Scale, and attitude toward COLLEGE serving as covariates. The criterion variable was the posttest score on the Nelson Biology Test.

Self Concept

Hypotheses 4<sub>c</sub>, 5<sub>c</sub>, and 6 were tested using 2 X 2 analysis of covariance with unequal and disproportionate cell frequencies. The pretest score on the Tennessee Self Concept Scale was the covariate and the posttest score the criterion.
Attitude

The pretest scores on the semantic differentials COLLEGE and LEARNING CENTER were subjected to a factor analysis evaluation. Adjective pairs which were determined to be evaluative adjectives for a concept were summed for each subject. This sum was divided by the number of evaluative scales to determine the individual student's attitude score toward a specific concept. Students at College A and College B were combined for the factor analysis concerning COLLEGE. Only College A students were used on the analysis concerning LEARNING CENTER.

Hypotheses 4d, 5d, and 7 were tested by the 2 X 2 analysis of covariance with unequal and disproportionate cell frequencies. The pretest score served as the covariate and the posttest score served as the criterion.

Hypothesis 4e was tested by simple analysis of covariance. The pretest score on the LEARNING CENTER concept was used as covariate. The posttest score was the criterion variable.

Hypothesis 8 was tested by performing a t-test for correlated means.

Personal Data

The personal data sheets were used to provide descriptive data. The individual items on these sheets were tallied and frequency and percentage breakdowns were reported earlier in Chapter III.
CHAPTER BIBLIOGRAPHY


CHAPTER IV

ANALYSIS OF DATA

The results of statistical analysis of test data concerning achievement, self-concept, and attitude are presented in this chapter. Data processing was performed by the Data Processing Center at North Texas State University. The level of significance is reported for each hypothesis when tested in the null form, and for ease of interpretation the 0.05 level of significance was arbitrarily selected as the point of rejection for each null hypothesis.

Tables I through IV were discussed in Chapter III.

Table V indicates the number of students receiving the various pretests and posttests. A total of 186 students at College A received the pretest in English while only 137 completed the posttests. Thirty-one completed only part of the posttest. Absences, transfers, and withdrawals accounted for 18 students not receiving the posttest. The pretest was administered to 175 English students at College B, while 245 completed the posttest. Thirty-six students completed only part of the posttest. Three faculty members at College B failed to administer the English pretest to five sections containing a total of 116 students. These five
sections were administered the posttest which accounts for the increase in the number of posttests over the number of pretests administered at College B.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
</tr>
<tr>
<td>Cooperative English Tests</td>
<td>186</td>
<td>137</td>
</tr>
<tr>
<td>Nelson Biology Test</td>
<td>92</td>
<td>67</td>
</tr>
<tr>
<td>Tennessee Self Concept Scale</td>
<td>208</td>
<td>166</td>
</tr>
<tr>
<td>Semantic Differential COLLEGE</td>
<td>211</td>
<td>145</td>
</tr>
<tr>
<td>Semantic Differential LEARNING CENTER</td>
<td>211</td>
<td>145</td>
</tr>
</tbody>
</table>

The pretest was administered to 92 College A biology students and to 67 College B biology students. The posttest was administered to 67 students at College A and to 62 students at College B.

All tests were administered by the teachers involved in the various sections. One biology instructor at College A failed to administer the semantic differential posttest to 131 students. Fortunately 96 of these students received the instrument in English and only 35 were lost to
any one aspect of the study. Any attempt to administer the semantic differential to this group at a later date would have introduced more undesirable variables than the effect of the loss on the study.

Table VI lists the various pretest means for each of the covariates. The means and cell frequencies are given for each cell as used in the 2 X 2 analysis of covariance.

**TABLE VI**

**UNADJUSTED PRETEST MEANS AND CELL FREQUENCIES FOR ALL COVARIATES**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resident</td>
<td>Commuter</td>
</tr>
<tr>
<td><strong>Cooperative English Tests</strong></td>
<td>98.09</td>
<td>94.35</td>
</tr>
<tr>
<td></td>
<td>N=45</td>
<td>N=65</td>
</tr>
<tr>
<td><strong>Nelson Biology Test</strong></td>
<td>25.92</td>
<td>27.94</td>
</tr>
<tr>
<td></td>
<td>N=25</td>
<td>N=36</td>
</tr>
<tr>
<td><strong>Tennessee Self Concept Scale</strong></td>
<td>337.97</td>
<td>334.96</td>
</tr>
<tr>
<td></td>
<td>N=67</td>
<td>N=92</td>
</tr>
<tr>
<td><strong>COLLEGE</strong></td>
<td>5.88</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td>N=56</td>
<td>N=82</td>
</tr>
<tr>
<td><strong>LEARNING CENTER</strong></td>
<td>5.66</td>
<td>5.84</td>
</tr>
<tr>
<td></td>
<td>N=56</td>
<td>N=82</td>
</tr>
<tr>
<td><strong>ACT English</strong></td>
<td>18.20</td>
<td>18.09</td>
</tr>
<tr>
<td></td>
<td>N=45</td>
<td>N=65</td>
</tr>
<tr>
<td><strong>ACT Natural Science</strong></td>
<td>19.24</td>
<td>20.06</td>
</tr>
<tr>
<td></td>
<td>N=25</td>
<td>N=36</td>
</tr>
</tbody>
</table>
Table VI indicates similarities between the students at College A and College B on the pretest means of the various covariates.

The posttest means are displayed in Table VII.

### TABLE VII

**UNADJUSTED POSTTEST MEANS AND CELL FREQUENCIES FOR ALL CRITERION**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>College A</th>
<th>College B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resident</td>
<td>Commuter</td>
</tr>
<tr>
<td>Cooperative English Tests</td>
<td>106.24</td>
<td>104.74</td>
</tr>
<tr>
<td></td>
<td>N=45</td>
<td>N=65</td>
</tr>
<tr>
<td>Nelson Biology Test</td>
<td>32.04</td>
<td>34.36</td>
</tr>
<tr>
<td></td>
<td>N=25</td>
<td>N=36</td>
</tr>
<tr>
<td>Tennessee Self Concept Scale</td>
<td>342.82</td>
<td>335.60</td>
</tr>
<tr>
<td></td>
<td>N=67</td>
<td>N=92</td>
</tr>
<tr>
<td>COLLEGE</td>
<td>5.47</td>
<td>5.51</td>
</tr>
<tr>
<td></td>
<td>N=56</td>
<td>N=82</td>
</tr>
<tr>
<td>LEARNING CENTER</td>
<td>4.90</td>
<td>5.08</td>
</tr>
<tr>
<td></td>
<td>N=56</td>
<td>N=82</td>
</tr>
</tbody>
</table>

Examination of Tables VI and VII shows that both College A and College B resident and commuter groups achieved higher posttest group means, after one semester on the **Cooperative English Tests**, than their corresponding pretest group means. The experimental group experienced a larger increase between pretest and posttest group means than did the control group.
The four groups attained similar mean changes on the Nelson Biology Test, but the difference between pretest means and posttest means was not quite so pronounced.

The resident students at College A experienced an approximate 5 point increase in self-concept, whereas the control resident group mean indicated a slight decrease in total positive score on the self-concept instrument. Each of the commuter group means increased less than 2 points on the self-concept scale.

The semantic differential attitude scale toward college was administered at both colleges. The difference between the pretest attitude scores for College A and College B resident students was less than 0.1 of a point on a 7 point scale. Both groups experienced a decline in attitude score during the semester. College B resident students declined 0.03 of a point and College A resident students declined 0.41 of a point. The posttest attitude scores of both resident groups were still very favorable since both exceeded the 4.5 figure necessary for a score to be considered favorable.

The commuter students at College A and College B experienced similar decreases in attitude scores during the semester. College A commuters had a favorable pretest score of 6.00, but declined to a still favorable attitude score of 5.51. College B commuters had an initial favorable
score of 6.01 and declined to a favorable attitude score of 5.82.

The semantic differential measuring the student's attitude toward the concept LEARNING CENTER was administered only at College A. The commuter group pretest attitude score of 5.84 was slightly higher than the resident group score of 5.66. Although both groups experienced decreases of 0.76 of a point, both the commuter students and resident students maintained a favorable attitude toward the Learning Center after one semester.

English Achievement

The instrument used to measure English achievement was the Cooperative English Tests, Form 1A, published by Educational Testing Service, Princeton, New Jersey. The instrument administered consisted of two tests, each being a timed test composed of two parts. There was a total of 210 questions, thus permitting achievement scores to range from 0 to 210.

In the comparison of the experimental group with the control group, the ACT English score and the pretest scores on the Cooperative English Tests, Tennessee Self Concept Scale, and semantic differential COLLEGE were used as covariates. The criterion variable was the posttest score on the Cooperative English Tests. Table VIII summarizes
the residuals for the 2 X 2 analysis of covariance used to analyze hypotheses 1a, 2a, 3a, 4a, and 5a.

**TABLE VIII**

SUMMARY FOR THE ANALYSIS OF COVARIANCE HYPOTHESES 1a, 2a, 3a, 4a, AND 5a  
COOPERATIVE ENGLISH TESTS

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>19.19</td>
<td>1</td>
<td>19.19</td>
<td>0.1368</td>
<td>0.7119</td>
</tr>
<tr>
<td>Columns</td>
<td>701.09</td>
<td>1</td>
<td>701.09</td>
<td>4.9990</td>
<td>0.0264</td>
</tr>
<tr>
<td>Interaction</td>
<td>36.85</td>
<td>1</td>
<td>36.85</td>
<td>0.2628</td>
<td>0.6088</td>
</tr>
<tr>
<td>Within</td>
<td>28610.17</td>
<td>204</td>
<td>140.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29367.30</td>
<td>207</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The research hypotheses, as stated in Chapter I, have been restated as follows:

1a. The experimental group (Group Ex) will achieve a significantly higher adjusted posttest mean, after one semester, than will the control group (Group Ct) on the Cooperative English Tests.

2a. The experimental commuter group (Group Excm) will achieve a significantly higher adjusted posttest mean, after one semester, than will the control commuter group (Group Ctcm) on the Cooperative English Tests.
3a. The experimental resident group (Group Exrs) will achieve a significantly higher adjusted posttest mean, after one semester, than will the control resident group (Group Ctrs) on the Cooperative English Tests.

4a. There will be no significant difference in the adjusted posttest means between Group Excm and Group Exrs, after one semester, on the Cooperative English Tests.

5a. There will be no significant difference in the adjusted posttest means between Group Ctcm and Group Ctrs, after one semester, on the Cooperative English Tests.

Table IX indicates the adjusted means for the criterion. These means were obtained from an analysis of the simple effects. All hypotheses were tested in the null form. Results pertaining to these hypotheses are given in Table VIII and Table IX. The F ratio of \( \frac{ms'_{rxc}}{ms'_{w}} = 0.2628 \) and \( p = 0.6068 > 0.05 \) indicated that there was no significant interaction. The F ratio of \( \frac{ms'_{r}}{ms'_{w}} = 0.1368 \) and \( p = 0.7119 > 0.05 \) indicated no significant difference between the rows, but the F ratio of \( \frac{ms'_{c}}{ms'_{w}} = 4.9990 \) and \( p = 0.0264 < 0.05 \) indicated significant difference between the columns.
Table IX indicates the significant difference to be in favor of College A.

Hypothesis 1a was rejected at the 0.05 level when stated in the null form, and the statistical data indicated the research hypothesis was substantiated at the 0.05 level of significance.

The rejection of null hypothesis 1a combined with the absence of significant interaction implied the rejection of hypotheses 2a and 3a when stated in the null form. Research hypotheses 2a and 3a were verified by these data.

The lack of significant difference between rows, indicated by the F and p values for the rows, implied that
hypotheses $4_a$ and $5_a$ were retained in the null form.
Research hypotheses $4_a$ and $5_a$, originally stated in the null form, were confirmed by these data.

Biology Achievement

The Nelson Biology Test, published by Harcourt, Brace and World, Inc., New York, was used to measure achievement in biology. The test was a timed test consisting of sixty-five questions with possible scores ranging from 0 to 65.

In the comparison of the experimental group with the control group, the ACT National Science score and the pretest scores on the Nelson Biology Test, Tennessee Self Concept Scale, and semantic differential COLLEGE were used as covariates. The criterion variable was the Nelson Biology Test posttest score.

Table X indicates the residuals for the $2 \times 2$ analysis of covariance used to analyze hypotheses $1_b, 2_b, 3_b, 4_b, \text{ and } 5_b$.

The research hypotheses, as stated in Chapter I, have been restated as follows:

1b. Group Ex will achieve a significantly higher adjusted posttest mean, after one semester, than will Group Ct on the Nelson Biology Test.

2b. Group Excm will achieve a significantly higher adjusted posttest mean, after one semester, than will Group Ctc on the Nelson Biology Test.
3b. Group Exrs will achieve a significantly higher adjusted posttest mean, after one semester, than will Group Ctrs on the Nelson Biology Test.

4b. There will be no significant difference in the adjusted posttest means between Group Excm and Group Exrs, after one semester, on the Nelson Biology Test.

5b. There will be no significant difference in the adjusted test means between Group Ctcp and Group Ctrs, after one semester, on the Nelson Biology Test.

### Table X

**SUMMARY FOR THE ANALYSIS OF COVARIANCE HYPOTHESES 1b, 2b, 3b, 4b, AND 5b NELSON BIOLOGY TEST**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>19.73</td>
<td>1</td>
<td>19.73</td>
<td>0.5181</td>
<td>0.4733</td>
</tr>
<tr>
<td>Columns</td>
<td>3.64</td>
<td>1</td>
<td>3.64</td>
<td>0.0956</td>
<td>0.7578</td>
</tr>
<tr>
<td>Interaction</td>
<td>46.53</td>
<td>1</td>
<td>46.53</td>
<td>1.2222</td>
<td>0.2716</td>
</tr>
<tr>
<td>Within</td>
<td>3730.86</td>
<td>98</td>
<td>38.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3800.76</td>
<td>101</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table XI presents adjusted means and frequencies for each cell, row totals, and column totals. These means
were obtained from simple analysis of covariance on the simple effects.

Hypotheses $l_b$, $2_b$, $3_b$, $4_b$, and $5_b$ were all tested in the null form and interpreted using data from Table X and Table XI. There was no significant interaction since the interaction $F = 1.2222$ and $p = 0.2716 > 0.05$. Examination of Table X for main effects shows that with the row $F = 0.5181$ and $p = 0.4733 > 0.05$ and the column $F = 0.0956$ and $p = 0.7578 > 0.05$ there was no significant main effect.

**TABLE XI**

**ADJUSTED MEANS AND CELL FREQUENCIES**

**NELSON BIOLOGY TEST**

<table>
<thead>
<tr>
<th></th>
<th>College A</th>
<th>College B</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident</td>
<td>$\bar{x} = 35.19$</td>
<td>$\bar{x} = 36.41$</td>
<td>$\bar{x} = 35.92$</td>
</tr>
<tr>
<td></td>
<td>$N = 25$</td>
<td>$N = 35$</td>
<td>$N = 60$</td>
</tr>
<tr>
<td>Commuter</td>
<td>$\bar{x} = 35.48$</td>
<td>$\bar{x} = 34.08$</td>
<td>$\bar{x} = 35.18$</td>
</tr>
<tr>
<td></td>
<td>$N = 36$</td>
<td>$N = 10$</td>
<td>$N = 46$</td>
</tr>
<tr>
<td>Columns</td>
<td>$\bar{x} = 35.36$</td>
<td>$\bar{x} = 35.89$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$N = 61$</td>
<td>$N = 45$</td>
<td></td>
</tr>
</tbody>
</table>

Hence, hypothesis $l_b$, when stated in the null form, was retained at the 0.05 level and the research hypothesis was not confirmed. Hypotheses $2_b$ and $3_b$ were retained in
the null form and the research hypotheses were not substantiated at the 0.05 level.

Hypotheses 4b and 5b were retained in the null form and thus research hypotheses 4b and 5b were retained at the 0.05 level.

**Self-Concept**

The *Tennessee Self Concept Scale*, developed by William H. Fitts and published by Counselor Recordings and Tests, Nashville, Tennessee, was used to measure self-concept of the subjects. The "Total Positive Score" was used as the individual's self-concept score.

The pretest score served as the covariate, and the posttest score served as the criterion for the 2 X 2 analysis of covariance used to compare the experimental and control groups. Table XII presents the residuals obtained in the analysis along with F and p values for hypotheses 4c, 5c, 6a, 6b, and 6c.

The research hypotheses, as stated in Chapter I, have been restated as follows:

4c. There will be no significant difference in the adjusted posttest means between Group Excm and Group Exrs, after one semester, on the *Tennessee Self Concept Scale*.

5c. There will be no significant difference in the adjusted posttest means between Group Ctcm and
Group Ctrs, after one semester, on the *Tennessee Self Concept Scale*.

6. There will be a significant mean change between pretest means and posttest means on the *Tennessee Self Concept Scale* favoring the experimental group, after one semester, between the following:
   a. Group Ex and Group Ct
   b. Group Excm and Group Ctnm
   c. Group Exrs and Group Ctrs.

**TABLE XII**

**SUMMARY FOR THE ANALYSIS OF COVARIANCE HYPOTHESES 4c, 5c, 6a, 6b, AND 6c TENNESSEE SELF CONCEPT SCALE**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>1004.80</td>
<td>1</td>
<td>1004.80</td>
<td>1.5927</td>
<td>0.2076</td>
</tr>
<tr>
<td>Columns</td>
<td>2034.17</td>
<td>1</td>
<td>2034.17</td>
<td>3.2244</td>
<td>0.0733</td>
</tr>
<tr>
<td>Interaction</td>
<td>153.94</td>
<td>1</td>
<td>153.94</td>
<td>0.2440</td>
<td>0.6216</td>
</tr>
<tr>
<td>Within</td>
<td>244760.72</td>
<td>388</td>
<td>630.88</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Total</td>
<td>247973.63</td>
<td>391</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Table XIII presents adjusted means and cell frequencies for each cell, along with row and column summations. These data were obtained from an analysis of covariance on the simple effects.
TABLE XIII
ADJUSTED MEANS AND CELL FREQUENCIES
TENNESSEE SELF CONCEPT SCALE

<table>
<thead>
<tr>
<th></th>
<th>College A</th>
<th>College B</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 67</td>
<td></td>
<td>N = 185</td>
<td>N = 252</td>
</tr>
<tr>
<td>$\bar{x} = 336.80$</td>
<td>$\bar{x} = 331.48$</td>
<td>$\bar{x} = 332.89$</td>
<td></td>
</tr>
<tr>
<td>Commuter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 92</td>
<td></td>
<td>N = 49</td>
<td>N = 141</td>
</tr>
<tr>
<td>$\bar{x} = 330.96$</td>
<td>$\bar{x} = 329.60$</td>
<td>$\bar{x} = 330.56$</td>
<td></td>
</tr>
<tr>
<td>Columns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = 159</td>
<td></td>
<td>N = 234</td>
<td></td>
</tr>
<tr>
<td>$\bar{x} = 333.42$</td>
<td>$\bar{x} = 331.09$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All hypotheses were tested in the null form and interpreted, using data from Table XII and Table XIII. Interaction $F = 0.2440$ and $p = 0.6216 > 0.05$ indicated that there was no significant interaction. The row $F = 1.5927$ and $p = 0.2076 > 0.05$ indicated that there was no significant difference between the rows. Hence, hypotheses $4_c$ and $5_c$ were retained in the null form. Therefore, research hypotheses $4_c$ and $5_c$ were verified by these data at the 0.05 level of significance.

Column $F = 3.2244$ and $p = 0.0733 > 0.05$ indicated there was no significant difference between Group Ex and Group Ct. Thus, hypothesis $6_a$ was retained in the null
form, and research hypothesis $H_a$ was not substantiated at the 0.05 level. The retention of hypotheses $H_b$ and $H_c$ in the null form follows since the interaction effect was nonsignificant. Hence, research hypotheses $H_b$ and $H_c$ were not substantiated.

Attitude

The semantic differential pretests were submitted to a principal-axis factor analysis in order to determine which of the bi-polar adjective pairs were evaluative adjectives. Each concept was subjected to a separate factor analysis. College A and College B students were combined for the factor analysis on the COLLEGE concept. The factor analysis on the LEARNING CENTER concept was limited to the students at College A.

The factor analysis for the COLLEGE concept produced a factor loading matrix which was subjected to a verimax rotation to determine loading values for each adjective pair on each of three factors of a semantic space. The evaluative, potency, and activity factors accounted for 52.4 per cent of the total test variance. Seven adjective pairs were determined to be evaluative adjectives. These seven pairs were complete-incomplete, successful-unsuccessful, meaningful-meaningless, positive-negative, reputable-disreputable, wise-foolish, and motivated-aimless. These
adjective pairs were used to determine the student's attitude score for both the pretest and posttest.

The factor analysis for the LEARNING CENTER concept produced a factor loading matrix. Following a verimax rotation to determine the loading values for the adjective pairs, ten adjective pairs were found to be evaluative. The three factors on which the adjectives loaded accounted for 61.3 per cent of the total test variance. The ten evaluative adjective pairs used to determine attitude toward the LEARNING CENTER concept were good-bad, complete-incomplete, graceful-awkward, pleasurable-painful, successful-unsuccedful, meaningful-meaningless, important-unimportant, positive-negative, wise-foolish, and active-passive.

The pretest score was used as the covariate and the posttest score as the criterion for the 2 X 2 analysis of covariance in comparing the experimental and control groups. Table XIV presents the residuals obtained in the analysis along with F and p values for hypotheses 4d, 5d, 7a, 7b, and 7c.

The research hypotheses, as stated in Chapter I, have been restated as follows:

4d. There will be no significant difference in the adjusted posttest means between Group Excm and Group Exrs, after one semester, on the Semantic Differential: COLLEGE.
5d. There will be no significant difference in the adjusted posttest means between Group Ctcp and Group Ctrp, after one semester, on the Semantic Differential: COLLEGE.

7. There will be a significant mean change between pretest means and posttest means concerning attitude toward COLLEGE, after one semester, in favor of the experimental group between the following:
   a. Group Ex and Group Ct
   b. Group Excm and Group Ctcp
   c. Group Exrs and Group Ctrp.

### TABLE XIV

**SUMMARY FOR THE ANALYSIS OF COVARIANCE HYPOTHESES 4d, 5d, 7a, 7b, AND 7c COLLEGE**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>DF</th>
<th>Mean of Squares</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>11.06</td>
<td>1</td>
<td>11.06</td>
<td>0.2877</td>
<td>0.5920</td>
</tr>
<tr>
<td>Columns</td>
<td>466.76</td>
<td>1</td>
<td>466.76</td>
<td>12.1361</td>
<td>0.0006</td>
</tr>
<tr>
<td>Interaction</td>
<td>9.43</td>
<td>1</td>
<td>9.43</td>
<td>0.2482</td>
<td>0.6207</td>
</tr>
<tr>
<td>Within</td>
<td>14461.06</td>
<td>376</td>
<td>38.46</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Total</td>
<td>14948.31</td>
<td>379</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
</tbody>
</table>

Table XV presents adjusted means and cell frequencies for each cell as well as the row and column summations.
These data were obtained from analysis of covariance on the simple effects.

TABLE XV

ADJUSTED MEANS AND CELL FREQUENCIES

<table>
<thead>
<tr>
<th>College</th>
<th>College A</th>
<th>College B</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident</td>
<td>$\bar{x} = 5.50$</td>
<td>$\bar{x} = 5.91$</td>
<td>$\bar{x} = 5.82$</td>
</tr>
<tr>
<td>$N = 56$</td>
<td>$N = 193$</td>
<td>$N = 249$</td>
<td></td>
</tr>
<tr>
<td>Commuter</td>
<td>$\bar{x} = 5.49$</td>
<td>$\bar{x} = 5.81$</td>
<td>$\bar{x} = 5.61$</td>
</tr>
<tr>
<td>$N = 82$</td>
<td>$N = 50$</td>
<td>$N = 132$</td>
<td></td>
</tr>
<tr>
<td>Column</td>
<td>$\bar{x} = 5.50$</td>
<td>$\bar{x} = 5.89$</td>
<td></td>
</tr>
<tr>
<td>$N = 138$</td>
<td>$N = 243$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All hypotheses were tested in the null form and interpreted using data from Table XIV and Table XV. The interaction $F = 0.2482$ and $p = 0.6207 > 0.05$ indicated there was no significant interaction. The row $F = 0.2877$ and $p = 0.5920 > 0.05$ indicated a lack of significant difference between the rows. Hence, hypotheses $4_d$ and $5_d$ were retained in the null form. Since research hypotheses $4_d$ and $5_d$ were stated in the null form, these data confirm the research hypotheses.
The column \( F = 12.1361 \) and \( p = 0.0006 < 0.05 \) indicated a significant difference between the columns. Hence, hypothesis \( 7_a \) was rejected in the null form at the 0.05 level of significance. Research hypothesis \( 7_a \) was rejected in favor of Group C\( \alpha \) as indicated by the adjusted means in Table XV. The absence of significant interaction, the rejection of hypothesis \( 7_a \) in the null form, and the rejection of directional research hypothesis \( 7_a \) combined with data in Table XV called for the rejection of hypotheses \( 7_b \) and \( 7_c \) in both the null form and the directional form of the research hypotheses.

Hypothesis 4\( _e \), as stated in Chapter I, has been re-stated as follows:

\( 4_e. \) There will be no significant difference in the posttest means between Group Excm and Group Exrs, after one semester, on the Semantic Differential: LEARNING CENTER.

Table XVI is a summary of the residuals from simple analysis of covariance where the covariate was the pretest score on the concept LEARNING CENTER and the posttest score was the criterion.

From Table XVI, \( p = 0.7567 > 0.05 \) indicates no significant difference between the two groups. Hypothesis 4\( _e \) was retained in the null form. Hence, research hypothesis 4\( _e \) was verified by these data.
Hypothesis 8, as stated in Chapter I, has been restated as follows:

8. There will be a significant mean change between the pretest mean and posttest mean, after one semester, concerning attitude toward the LEARNING CENTER of the following:
   a. Group Ex
   b. Group Excm
   c. Group Exrs.

Table XVII presents data pertaining to the students at College A. A two-tailed t-test for correlated means was used to determine the significance between pretest and posttest means on the concept LEARNING CENTER.
Hypothesis $8_a$, combined group, was rejected in the null form at the 0.05 level of significance in favor of a directional hypothesis in the negative direction.

Hypothesis $8_b$, Group Excm, was rejected in the null form in favor of a directional hypothesis in the negative direction at the 0.05 level of significance.

Hypothesis $8_c$, Group Exrs, was rejected in the null form in favor of a directional hypothesis in the negative direction at the 0.05 level of significance.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study involved two private, co-educational colleges in the Southwest. College A, experimental program, utilized an electronic remote access information retrieval system to implement English and biology curricula. College B, control program, emphasized a lecture-discussion approach to teaching. First-semester college freshmen enrolled for English or biology served as subjects. The purpose of this study was to determine the ability of the experimental method of teaching to achieve desired growth in intellectual maturity of the individual student.

Summary

Descriptive data confirmed the expected difference in the percentages of resident and commuter students at the two colleges. Consequently, a 2 X 2 factorial design utilizing method of instruction as one factor and resident-commuter status as the other factor served as the basic design for data analysis. Most of the hypotheses were tested with 2 X 2 analysis of covariance with unequal and disproportionate cell frequencies.
As previously discussed, the selection of a control group outside College A was necessitated by the fact that all freshman students received exposure to the learning center approach. College B was selected in an attempt to eliminate as many differences as possible between the two student bodies used in the study.

Descriptive data provided for each school was used as a comparison for the two student bodies. Fall enrollment figures were considerably closer for the two fall semesters prior to the study than for the fall semester the study was conducted.

No attempt was made to equate the English and biology faculties involved. Review of literature concerning teacher effectiveness and teacher ratings did not produce a feasible method of equating the quality of instruction of the faculties of the two institutions. The descriptive data concerning teachers was provided as information only.

Chapter I and Chapter IV contain complete statements of the hypotheses. Table XVIII serves as a summary table for the research hypotheses. Some of the research hypotheses were stated as directional while others were stated in the null form. The level of significance is indicated for each hypothesis, but the 0.05 level of significance was arbitrarily chosen as the level for rejection of the null hypotheses as well as the level for verification of the research hypotheses.
### TABLE XVIII
SUMMARY OF DATA OBTAINED FROM THIS STUDY

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>F</th>
<th>p</th>
<th>Hypothesis Retained or Rejected*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>4.9990</td>
<td>0.0264</td>
<td>retain</td>
</tr>
<tr>
<td>1b</td>
<td>0.0956</td>
<td>0.7578</td>
<td>reject</td>
</tr>
<tr>
<td>2a**</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>2b**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>3a**</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>3b**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>4a***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>4b***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>4c***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>4d***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>4e</td>
<td>0.0964</td>
<td>0.7567</td>
<td>retain</td>
</tr>
<tr>
<td>5a***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>5b***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>5c***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>5d***</td>
<td>. .</td>
<td>. .</td>
<td>retain</td>
</tr>
<tr>
<td>6a</td>
<td>3.2244</td>
<td>0.0733</td>
<td>reject</td>
</tr>
<tr>
<td>6b**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>6c**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>7a</td>
<td>12.1361</td>
<td>0.0006</td>
<td>reject</td>
</tr>
<tr>
<td>7b**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>7c**</td>
<td>. .</td>
<td>. .</td>
<td>reject</td>
</tr>
<tr>
<td>8a</td>
<td>6.8554</td>
<td>0.0001</td>
<td>retain</td>
</tr>
<tr>
<td>8b</td>
<td>5.3574</td>
<td>0.0001</td>
<td>retain</td>
</tr>
<tr>
<td>8c</td>
<td>4.2437</td>
<td>0.0002</td>
<td>retain</td>
</tr>
</tbody>
</table>

*0.05 level of significance.

**Follows from corresponding column main effects.

***Follows from corresponding row main effects.

These data confirmed hypotheses 1a, 2a, and 3a which hypothesized a significantly higher achievement, after one semester, by the experimental group. With the covariates held constant, these data substantiated the three directional research hypotheses while not producing any
significant difference between the resident and commuter factor. Thus, hypotheses 4a and 5a were also verified.

Hypotheses 1b, 2b, and 3b were rejected in favor of the null hypotheses in all three cases. Examination of these data indicated no significant difference between the learning center method of teaching and the traditional lecture-discussion method for the biology classes. There was no significant difference involving the resident-commuter factor. Therefore, hypotheses 4b and 5b were confirmed, indicating there was no significant difference between the levels of achievement in biology for the resident and commuter students at their respective colleges.

All hypotheses relating to self-concept were retained in the null form. Consequently, there were no significant differences between Group Ex and Group Ct or between any of the subgroups of Group Ex and Group Ct. Hypotheses 4c and 5c were confirmed in the null form, whereas hypotheses 6a, 6b, and 6c were rejected in favor of the null form.

Hypotheses 4d and 5d, predicting no significant difference between Group Excm and Group Exrs or Group Ctcvm and Group Ctri, were verified in the null form by these data. Hypothesis 7, which predicted a significant mean change between the pretest and posttest means in favor of the experimental group, was rejected in favor of the control group. These data indicated the control group
maintained their attitude score toward COLLEGE at about the same level, while the adjusted attitude mean of the experimental group changed from a favorable attitude rating of 5.95 on a 7.0 point scale at the beginning of the study to a favorable unadjusted attitude mean of 5.49 on the same scale at the end of the study. The control group attitude means ranged from an initial attitude rating of 5.84 to a final unadjusted attitude rating of 5.89. Consequently, the decrease in the adjusted attitude rating of the experimental group combined with the increase of the control group caused hypotheses 7a, 7b, and 7c to be rejected.

The experimental group also had an attitude score on the LEARNING CENTER concept. The pretest rating score was 5.77, a favorable attitude, while the unadjusted posttest mean dropped to a lower score of 5.00, but still classified as a favorable attitude score according to the definition of favorable attitude for this study. Although the drop in the rating score occurred, the change was not sufficient to reject hypothesis 4e. These data indicated that hypothesis 4e should be retained. Thus, there was no significant difference between the attitude of Group Excm and Group Exrs after one semester's exposure to the learning center.

Hypothesis 8 was tested by a two-tailed t-test for correlated means and these data confirmed the hypothesis in
a negative direction. Consequently, hypotheses $\theta_a$, $\theta_b$, and $\theta_c$ were retained in the negative direction.

Findings

1. These data indicated the experimental program was superior to the control program with respect to English achievement.
2. The study indicated there was no significant difference between the two methods of teaching when related to achievement in biology.
3. Neither method of instruction seemed superior with respect to positive change in self-concept, after one semester.
4. The control group demonstrated a significantly greater positive change than the experimental group on attitude toward COLLEGE, after one semester.
5. The experimental group demonstrated a significant negative change in attitude toward LEARNING CENTER, after one semester.

Conclusions

Based upon the results of this study, no clear-cut mandate can be found for recommending one method of teaching over the other method.
Recommendations

The following recommendations are made based on the results obtained and experiences gained from this study.

1. It is recommended that a study be conducted in an attempt to identify specific factors of learning in both English and biology. These two sets of learning factors should be compared to determine what makes one subject matter field more receptive than the other to a particular method of teaching.

2. A longitudinal study examining the long-range effect of the learning center method on the student's self-concept should be conducted.

3. Group Ex experienced a decrease in attitude scale rating toward both concepts. The attitude scale rating of Group Ct showed a slight increase. An effort should be made to determine reasons for this difference. It might be possible that the decrease could be attributed to the social aspect of college life. College B appears to be a more socially active campus than College A.

4. One important recommendation involves a study to analyze the cost utilization factor of a learning center. The cost analysis should be conducted so that initial equipment and installation charges
are kept separate from the cost of using an electronic access system. The initial cost figures should be reported, but comparisons should be made with the cost of construction and equipping facilities necessary for any other method of instruction and not counted as part of the cost of instruction.

5. It is recommended that a study be made concerning the time a student spends in completing a course in the learning center as compared with the time another student spends under some other method of instruction. Grades, achievement, attitude, and possibly other factors should be involved in this type of study.

6. If a study involving two or more different student bodies is to be conducted, then it is recommended that more elaborate methods of equating the student groups be included. There should be an instrument used which would measure any differences in the social activities of each campus.
APPENDIX
<table>
<thead>
<tr>
<th>Measures</th>
<th>Fall 1969</th>
<th>Fall 1970</th>
<th>Fall 1971</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>College A</td>
<td>College B</td>
<td>College A</td>
</tr>
<tr>
<td>Enrollment</td>
<td>1,492</td>
<td>1,528</td>
<td>1,451</td>
</tr>
<tr>
<td>Tuition (per hour)</td>
<td>$30</td>
<td>$30</td>
<td>$30</td>
</tr>
<tr>
<td>Freshmen</td>
<td>537</td>
<td>549</td>
<td>451</td>
</tr>
<tr>
<td>Male</td>
<td>313</td>
<td>315</td>
<td>249</td>
</tr>
<tr>
<td>Female</td>
<td>224</td>
<td>234</td>
<td>202</td>
</tr>
<tr>
<td>Resident Degree Hours Taught</td>
<td>20,245</td>
<td>20,308</td>
<td>19,218</td>
</tr>
<tr>
<td>Full-Time Equivalent</td>
<td>1,397</td>
<td>1,334</td>
<td>1,314</td>
</tr>
<tr>
<td>Full-Time Faculty</td>
<td>73</td>
<td>73</td>
<td>85</td>
</tr>
<tr>
<td>Faculty-Student Ratio</td>
<td>1:19</td>
<td>1:18</td>
<td>1:15</td>
</tr>
</tbody>
</table>

*Compiled from official records.
<table>
<thead>
<tr>
<th>Institutions</th>
<th>ACT English Score Mean</th>
<th>ACT English Score Range</th>
<th>ACT Natural Science Score Mean</th>
<th>ACT Natural Science Score Range</th>
<th>ACT Composite Score Mean</th>
<th>ACT Composite Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College A</td>
<td>17.37</td>
<td>1-31</td>
<td>17.99</td>
<td>2-33</td>
<td>17.36</td>
<td>4-32</td>
</tr>
<tr>
<td>College B</td>
<td>19.10</td>
<td>4-32</td>
<td>18.30</td>
<td>1-32</td>
<td>19.10</td>
<td>4-31</td>
</tr>
<tr>
<td>1970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College A</td>
<td>18.78</td>
<td>1-30</td>
<td>18.81</td>
<td>2-33</td>
<td>18.82</td>
<td>6-31</td>
</tr>
<tr>
<td>College B</td>
<td>19.05</td>
<td>6-30</td>
<td>18.33</td>
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<td>19.07</td>
<td>6-29</td>
</tr>
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<td>1971</td>
<td></td>
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<tr>
<td>College A</td>
<td>17.96</td>
<td>2-29</td>
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<td>18.34</td>
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<td>20.54</td>
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<td>1-32</td>
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*Compiled from official records.
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