A COMPARISON OF TWO METHODS OF TEACHING THE
MANIPULATIVE SKILLS OF OFFICE MACHINES

APPROVED:

Graduate Committee:

[Signatures]

Major Professor

[Signature]

Minor Professor

[Signature]

Committee Member

[Signature]

Committee Member

Dean of the School of Education

[Signature]

Dean of the Graduate School
McKenzie, Jimmy C., *A Comparison of Two Methods of Teaching the Manipulative Skills of Office Machines*. Doctor of Education (College Teaching), May, 1972, 103 pp., 18 tables, 1 illustration, bibliography, 42 titles.

The problem with which this investigation is concerned is that of comparing a learning systems approach to a lecture-demonstration-rotation approach of teaching the manipulative skills of office machines. Achievement, student use hours, and attitude are the variables.

The study has four purposes: 1. to determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach to teaching the manipulative skills of office machines on achievement of those skills; 2. to determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach on the attitude toward a course in office machines; 3. to analyze the difference in student use time for a learning systems approach as compared to student use time for a lecture-demonstration-rotation approach; and, 4. to determine whether instructional exemption, or pretesting, should be an element of a learning systems approach for office machines.

Data was gathered from the office machines classes on two community college campuses. The experimental group
consisted of four classes on one campus with a final enrollment of sixty-seven. The control group consisted of three classes on one campus with a final enrollment of sixty-two.

The Otis Quick Scoring Mental Ability Test, Gamma series, and a questionnaire were administered to the two groups. The scores and information obtained from these two sources were used to determine the similarity of the two groups and for sub-grouping the two groups.

A t test was used to determine whether significant differences existed between group and sub-group achievement and student use time. A z test was used to determine whether significant differences existed between correlations of attitude and achievement and between attitude and student use time.

The findings of this study tended to support the hypothesis and sub-hypotheses that the learning systems approach will produce a significantly higher level of achievement on office machines. The group using the learning systems approach used significantly less time for completion of the course than did the group using the lecture-demonstration-rotation approach. The findings failed to support the hypothesis and sub-hypotheses that the correlation between attitude and achievement scores would be significantly higher for the group using the
learning systems approach. There was no significant
difference in student achievement for those with previous
training or experience on office machines and those with
no previous training or experience on office machines.

The following conclusions were drawn:

1. Achievement on office machines, especially for
the lower ability student, is significantly affected
favorably through the use of the learning systems approach
to instruction.

2. The self-pacing aspect of the learning systems
approach permits students to complete course requirements
in significantly less time without achievement being
adversely affected.

3. Previous training or experience on office machines
does not necessarily enable a student to achieve at a higher
level than a student with no previous training or experience
on office machines.

Recommendations for further studies and operating the
learning systems approach were also included.
A COMPARISON OF TWO METHODS OF TEACHING THE
MANIPULATIVE SKILLS OF OFFICE MACHINES

DISSERTATION

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

For the Degree of

DOCTOR OF EDUCATION

By

Jimmy C. McKenzie, B. S., M. Ed.
Denton, Texas
May, 1972
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CHAPTER I

INTRODUCTION

A community junior college, by operating with an "open door" philosophy, is faced with an immense task of meeting the needs of students who have varied backgrounds and different levels of achievement. The acceptance of this responsibility, coupled with technological advances and continually rising costs of operation, has resulted in many innovative ideas, concepts, machines, and approaches to instruction, contributed by both education and industry. The instructor in the community college, as well as other institutions, must analyze the new innovations and approaches and use the best of them in the classroom. The success and progress of the student is contingent upon how correctly and imaginatively the instructor is able to analyze and apply the innovations and approaches.

One method currently receiving considerable emphasis in education is a learning systems approach that enables students to work individually and progress at their own rates. Described by Place as many components coordinated

to enable a student or a group of students to orderly achieve a goal or set of goals, a learning systems approach appears to have wide applicability to many areas of instruction.

Office and business education have utilized a systems approach in a major curriculum study called New Office and Business Education Learning System (NOBELS). The influence of the NOBELS study, acceptance of the responsibility for individualizing instruction, and availability of materials and resources are resulting in attempts to implement the systems approach into various business education classrooms.

One of the basic necessities of a systems approach is an efficient and effective method of presenting materials when, and as often as, a student requires them. In a study conducted by Edwards, filmloops were used to successfully teach the skills of office machines. The removal of the materials presentation barrier allowed the implementation of the systems approach into the office machines classroom.

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2 Frank W. Lanham, A Planning Study to Determine the Feasibility of Developing a New Business and Office Education Curriculum, Moonshot—an Office Occupation Curriculum (Columbus, 1968).

Statement of the Problem

The problem of this study was a comparison of a learning systems approach to a lecture-demonstration-rotation approach to teaching the manipulative skills of office machines.

Purposes

A primary purpose of this study was to determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach to teaching the manipulative skills of office machines on achievement of those skills as measured by published office machines tests. A second purpose of this study was to determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach on the attitude toward a course in office machines as measured by a semantic differential. A third purpose was to analyze the difference in student use time for a learning systems approach as compared to student use time for a lecture-demonstration-rotation approach. Another purpose was to determine whether instructional exemption, or pretesting, should be an element of the learning systems approach for office machines.

Hypotheses

The following hypotheses were tested in this study:

1. The mean score on the achievement tests for the group
taught by the learning systems approach, hereafter referred to as Group A, will be significantly higher than for the group taught by the lecture-demonstration-rotation approach, hereafter referred to as Group B.

2. The correlation between attitude and achievement test scores will be significantly higher for Group A than for Group B.

3. Sub-groups based on intelligence test scores will show significant differences as follows:

   (a) The mean score on the achievement tests for Group A whose intelligence test scores are at or above the sixty-seventh percentile will be significantly higher than for Group B whose intelligence test scores are at or above the sixty-seventh percentile.

   (b) The mean score on the achievement tests for Group A whose intelligence test scores are between the thirty-third and the sixty-seventh percentiles will be significantly higher than for Group B whose intelligence test scores are between the thirty-third and the sixty-seventh percentiles.

   (c) The mean score on the achievement tests for Group A whose intelligence test scores are at or below the thirty-third percentile will be significantly higher than for Group B whose intelligence
test scores are at or below the thirty-third percentile.

(d) The correlation between attitude and achievement scores will be significantly higher for those in Group A whose intelligence test scores are at or above the sixty-seventh percentile than for those in Group B whose intelligence test scores are at or above the sixty-seventh percentile.

(e) The correlation between attitude and achievement scores will be significantly higher for those in Group A whose intelligence test scores fall between the thirty-third and the sixty-seventh percentiles than for those in Group B whose intelligence test scores fall between the thirty-third and the sixty-seventh percentiles.

(f) The correlation between attitude and achievement scores will be significantly higher for those in Group A whose intelligence test scores are at or below the thirty-third percentile than for those in Group B whose intelligence test scores are at or below the thirty-third percentile.

4. Sub-groups based on previous training or experience and no previous training or experience will show significant differences as follows:
(a) The mean score on the achievement tests for students in Group A who have had previous training or experience will be significantly higher than for students in Group B who have had previous training or experience.

(b) The mean score on the achievement tests for students in Group A who have had no previous training or experience will be significantly higher than for students in Group B who have had no previous training or experience.

(c) The correlation between attitude and achievement scores will be significantly higher for those in Group A who have had previous training or experience than for those in Group B who have had previous training or experience.

(d) The correlation between attitude and achievement scores will be significantly higher for those in Group A who have had no previous training or experience than for those in Group B who have had no previous training or experience.

5. The average hours of use time per student in Group A will be significantly less than the average hours of use time per student in Group B.

6. The correlation between attitude score and average hours of use time per student will be an inverse relation and will be significantly higher for Group A than for Group B.
7. The mean score on the achievement tests for students who have had previous training or experience on office machines will be significantly higher than for students who have had no previous training or experience on office machines.

8. The correlation between attitude and achievement scores will be significantly higher for students who have had previous training or experience on office machines than for students who have had no previous training or experience on office machines.

If there was not a minimum of twenty subjects in a group or sub-group, that particular hypothesis was not tested.

Significance of the Study

The "information explosion" has confronted the classroom instructor with the problem of teaching more content in less time. To effectively initiate this teaching, new techniques are being developed and examined while past and present methods and techniques are being re-examined.

The effectiveness of the traditional lecture-demonstration-rotation approach to office machines instruction has been questioned repeatedly. None of the studies in office machines that compared the lecture-demonstration-rotation approach to another approach have found a significant difference favoring the lecture-demonstration-rotation approach. The lock-step limitation
inherent in rotation precludes the allowance for individual rates of learning. The limited mode of materials presentation, lecture and demonstration, reduces time and freedom for individual instruction as well as handicaps students with differing styles of learning. In defense of the lecture-demonstration-rotation approach, it is easy to operate and does not require a large amount of time and money to install.

Any approach that departs from tradition must receive careful study and evaluation. This is the only way new methodology can be successfully analyzed and revised so that it may be used to improve the present teaching situation, not just maintain it.

One promising new approach to office machines instruction is the learning systems approach. Study and evaluation must be conducted to determine whether this approach effects a higher level of achievement. There is no need to substitute one partially successful approach for another. In addition, there is a need to determine whether the learning rate and materials presentation limitations peculiar to the lecture-demonstration-rotation approach can be eliminated. There is also a need for determining whether the classroom instructor is able to function more efficiently in the classroom.
Student attitude toward learning has long been recognized as a major contributing factor to student success. Study and evaluation need to be conducted to determine whether either the lecture-demonstration-rotation approach or the learning systems approach affects student attitude more significantly than the other.

The questionable effectiveness of the traditional lecture-demonstration-rotation approach, the potential promise of the systems approach, and the necessity for investigating student attitude toward both approaches point out the need for a research study comparing the two approaches.

**Definition of Terms**

**Achievement** refers to the composite raw score obtained from three office machines achievement tests.

**Attitude** refers to the evaluative factor score obtained by the semantic differential technique for the concept "Office Machines."

**Exemption Evaluation** refers to the instructor's assessment of the learner's readiness for a learning activity.

**Experience** refers to the situation in which a student has used daily or was currently using daily one or more of the office machines included in this study on the job.
Formal Evaluation refers to the instructor's assessment of the learner's mastery of a learning activity.

In-Depth Study refers to optional activities that allow the learner to apply learned skills to a problem-solving situation.

Laboratory Use Time refers to the total amount of time a student spent working in the classroom during classtime and/or in the machines laboratory.

Learning Systems Approach refers to a combination of components arranged so as to facilitate learning for an individual.

Lecture-Demonstration-Rotation Approach refers to instruction that is conveyed by lecture and demonstration. The student progresses through required activities on a fixed time basis.

Objectives refers to statements that present exactly the conditions, outcomes, and skills needed to satisfactorily fulfill achievement requirements.

Optional Activities refers to diversified activities that permit the learner to approach learning by an approach different from the original one used.

Previous Training refers to the situation in which a student was taught to use one or more of the machines included in this study in a previous course in school.
Required Activities refers to specific activities presented in a variety of ways in order to facilitate learning.

Self Evaluation refers to the learner’s assessment of his own achievement of a learning activity.

Sub-Groups refers to the smaller groups resulting when Group A and Group B were divided on the basis of intelligence test scores and on the basis of previous or no previous training or experience on office machines.

Support refers to contributions to the learning situation that were made by media, software, and learning packages.

Delimitations

This study included those students enrolled in office machines classes on two community college campuses in the Fort Worth-Dallas metropolitan area during the fall semester, 1971. This delimitation provided control of related topics studied by students in the respective classes.

Basic Assumptions

1. It was assumed that the students would respond honestly and carefully to the instruments used for measurement purposes.

2. It was assumed that the students would accurately maintain laboratory use time records.
CHAPTER II

RELATED LITERATURE

Introduction

Research in office machines has been limited. While most of the studies conducted have involved surveys of businesses to determine what machines are used, a few have investigated various approaches and techniques in office machines instruction. Brief summaries of the studies with factors similar to the factors in the present study are given here.

Review of Related Research

The Corgan study.—A study was conducted by Corgan comparing the differences between the similar-processes method and the rotation method of office machines instruction. The prerequisites of the sample were advanced typewriting and sophomore standing. The variables used in the investigation were arithmetic diagnostic test scores, grade-point average, and time. Achievement was measured by a proficiency test.

Although Corgan found no significant difference between the two groups involved, the existing difference favored the group using the traditional rotation approach. Corgan concluded that, although the results were somewhat inconclusive, better results on proficiency tests could be expected by using the rotation approach. She additionally concluded that the best elements of the rotation and similar-processes approach might produce the most effective learning and teaching environment.

The study by Corgan was the only one reported that indicated an advantage for the group using the rotation approach. It leaves unanswered the question of whether the traditional approach or some other approach is superior. The combining of the best elements of the two approaches represents one of the basic concepts of a learning systems approach. Even though the present study does not include the best elements of the similar-processes method, it does include some of the best elements from other approaches to office machines instruction.

The Walters study.—A study was conducted by Walters\(^2\) comparing the achievement between a group using audio-tape instruction and a group using the traditional rotation

approach. Walters planned and produced the audio-tapes to present all machine instruction to the group in the experimental situation. The control group proceeded through the material in the traditional rotation approach. He found no significant statistical difference at the .05 level in achievement between the control group and the experimental group. He did state that the experimental group had a higher mean score or three of the four criterion measures administered.

An informal questionnaire was used to determine the attitude of the students toward the method. The response was favorable. Self-pacing was the prominent reason given for the preference of the experimental approach over the control approach. He recommended that a teacher should be available to give individual help and encouragement even though instruction may be taped. He also recommended that the students be allowed to move ahead at their own pace.

The study by Walters presented several factors similar to the present study. Instruction from a source other than the teacher was introduced. Interest in student attitude was reported. Self-pacing was recommended as a possibility for office machines. The teacher was also recognized as contributing more to the office machines classroom than just instruction. Although these factors were included in
Walters' study, there are still many unanswered questions. Even though instruction was provided by a source other than the teacher, results of achievement comparison between the two groups were inconclusive. There are still many areas of student attitude remaining to be explored. The recommendations for using self-pacing and for keeping the teacher in the classroom must be tried. All of these factors are included in the present study.

The Edwards study.—The successful use of media in teaching the operation of office machines has been reported by Edwards.\(^3\) He utilized an audio-visual-tutorial approach, with all instruction by eight-millimeter filmloop. An experimental group worked at its own rate, using twenty-two filmloops produced by Edwards. An assignment sheet was given to each student at the time he received his filmloop. The classroom and laboratory assistants were available any time between 8 a.m. and 5 p.m. unless a control class using the traditional approach was in session. There were two control groups which met for fifty minutes on Monday, Wednesday, and Friday of each week.

At the end of the semester, a test was given to each group. The experimental group was found to have achieved

at a significantly higher level (.025) than the control group. The majority of the experimental group indicated by informal questionnaire that they had a favorable attitude toward the approach they used. Edwards did not report the attitude of the control group. Edwards recommended that an instructor should be available to confer with the students during the day if problems should occur.

Many factors found in Edwards' study make it similar to the present study. One of the major hindrances to installing a learning systems approach is finding a successful approach to materials presentation. The study by Edwards has apparently provided a solution to the materials presentation problem in office machines. There are still many factors that remain to be explored. There is a need to verify that the filmloop mode of materials presentation functions satisfactorily in the learning systems approach. There is a need to investigate other areas of student attitude. Since both Walters and Edwards recommended that the teacher remain in the classroom, an instructional approach other than the traditional approach should be tried, with a teacher present in the classroom.

Other studies.--Most of the remaining research surveyed in office machines instruction compared achievement results
of instruction provided by some form or forms of media and instruction provided by the teacher. Most of the studies were at the master's level of work. Prominent among these studies were those conducted by Beard\textsuperscript{4} and Colbert.\textsuperscript{5}

Colbert built a slide-tape series to present office machines not usually found in the classroom. The purpose of the series was not to instruct her students in the operation of various machines but to acquaint them with the machines they would find in business.

Beard utilized taped instruction in teaching the operations of a specific calculator. She found no significant difference in achievement between the groups involved.

The possibility of using slide-tape series in office machines instruction was raised by the study conducted by Colbert. The question of whether the use of slide-tape series for purposes other than those in Colbert's study should be answered. Materials presentation was successful in that the experimental group attained as

\begin{align*}
\textsuperscript{4}& \text{Brenda Beard, "Development and Evaluation of Taped Programmed Instruction in Seven Basic Operations of the Marchant Automatic Rotary Calculator," unpublished master's thesis, School of Business, University of Tennessee, 1965.} \\
\textsuperscript{5}& \text{Bette J. Colbert, "The Development of an Audio-Visual Presentation of Office Machines for Use in Classroom Instruction in Office Education," unpublished master's thesis, School of Business, University of Wisconsin, 1967.}
\end{align*}
well as the control group. The question of materials presentation is still unanswered.

A review of related research illustrates the relevancy of the learning systems approach to office machines instruction. Previous office machines studies have provided the basic groundwork for implementing a study of a learning systems approach to office machines instruction. There remains the need of investigating the effectiveness of the learning systems approach in the office machines classroom.

Review of Related Literature

Described as a process for focusing on the totality of a problem and the interrelationships of the parts as they relate to the whole, the operation of the systems approach has been demonstrated by military, business, and government while education has just begun to recognize its applicability. As early as 1917, Erlang used a form of the systems approach to analyze complex problems connected with an intricate telephone exchange system. The emergence of the systems approach as it is recognized today is more readily related to the military and the period

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of time during and after World War II than to any other period of time. The systems approach, popularized by the military, was developed by "professional teachers, biologists, mathematicians, and physicists mobilized from the classroom" for professional fighters." Churchman sites British anti-submarine warfare efforts while Banathy discusses planning and development of combat aircraft as examples of the systems approach developed during World War II. Among the more emphatic demonstrations of the successful application of the systems approach is the development of the atomic bomb and the aerospace projects being conducted by the National Aeronautic and Space Administration.

Recognizing the success of the systems approach and the existence of systems outside the realm of military, industry was quick to apply the systems approach, then

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10 Churchman, op. cit., p. vii.


known as operations research,\textsuperscript{13} to various situations and problems in which they had experienced difficulty. First applications were connected with rather insignificant problems concerning production, marketing, finance, and transportation.\textsuperscript{14} With the advent of the computer and the realization that enormous amounts of material could be processed, the application of the systems approach acquired a new use in industry. This is illustrated by Bower and others\textsuperscript{15} when they contend that a successful business information system contributes better services, management, and provides a favorable environment for the accomplishment of the goals and attitudes of the business. Pfeiffer\textsuperscript{16} adds to this by stating that the systems approach in industry has rapidly evolved into a method of viewing situations involving greater uncertainties, more complex mixes, and objectives more difficult to define.

Possibly one of the most prominent exponents of the systems approach in business, as well as in government, is former Secretary of Defense, Robert McNamara. It was

\textsuperscript{13}Churchman, \textit{op. cit.}, p. ix.

\textsuperscript{14}Ibid., p. ix.


\textsuperscript{16}Pfeiffer, \textit{op. cit.}, p. 18.
during his administration that the application of the systems approach filtered from the realm of industry to the realm of government. In 1960 the phase of a systems approach known as program budgeting was used in making a decision not to manufacture additional B-52 bombers and not to produce a nuclear-powered B-70 bomber. The success of the program budgeting phase and other subsequent procedures involved in a systems approach has been so striking that in 1965 the systems approach was established as a matter of national policy.\(^\text{17}\)

The evolvement of the systems approach into the realm of education can be traced to the administrative area of the school. In an attempt to interpret situations that arise from the complexities of the world and to cope with change,\(^\text{18}\) school administrators began utilizing the program budgeting approach (commonly referred to as PPBS) of the systems approach. With the advent of different methods of teaching, a rising flood of innovation, the involvement of big business in education, and a stronger demand for economy, pressure of selection at both the administrative and the classroom level has forced the administrator and the classroom teacher to resort to an orderly way of viewing

\(^{17}\text{Ibid., pp. 18-26.}\)

\(^{18}\text{Banathy, op. cit., p. iii.}\)
a situation. At present, the most promising approach appears to be the systems approach. The procedure developed by "professional teachers for professional fighters" has traveled a complete cycle and is now ready to be applied to the classroom of its originator.

Basically, there are two types of systems recognized. The algorithmic system is a precise, exact analysis in operation. Careful planning and concrete decisions in all phases concerning components are made before the system is put into operation. There is no modification except for an emergency. An example of the algorithmic system is the space flight experiments currently being conducted. The heuristic system is also carefully planned but is based on a hunch about how to achieve a goal. It is designed so that components may be inserted, withdrawn, or modified at anytime during the operation of the system. An example of the heuristic system is a learning system as it is applied to the classroom.

Most learning systems in the classroom are comprised of many components. The student, the teacher, and

19Pfeiffer, op. cit., pp. 10-12.
20Ibid., p. 33.
instructional materials are identified by Knirk and Childs\textsuperscript{22} as the principal components of a learning system. Banathy\textsuperscript{23} expands the component list by including the counselor, facilities, and financial means. The foregoing does not include a complete list of components but does provide an idea of many components involved in systems planning.

In discussing the structure of a learning system, Banathy\textsuperscript{24} states that four functions should be accomplished. They are: selecting and assigning content, selecting and organizing the learning activities, managing the learners, and evaluating the learning while operating the system.

Popham and Baker\textsuperscript{25} have structured an empirical instructional model that specifies objectives, pre-assesses, presents learning activities, and evaluates. Banathy\textsuperscript{26} specifies that the structure of an educational system should contain parts that formulate specific learning objectives, measure the degree of prior attainment, identify what is to be learned, select alternate learning activities,

\textsuperscript{22}Frederick G. Knirk and John W. Childs, \textit{Instructional Technology} (New York, 1968), p. 43.

\textsuperscript{23}Banathy, \textit{op. cit.}, p. 87.

\textsuperscript{24}Ibid., p. 56.


\textsuperscript{26}Banathy, \textit{op. cit.}, pp. 29-30.
install the system, and evaluate the system. Most system structures investigated tended to follow these suggestions but did reflect the individual design of the person devising the system. Knirk and Childs\(^\text{27}\) affirm this idea when they state that ten different systems could be structured by ten different teachers using only their voices and a chalkboard.

In discussing the structure of a system, Banathy\(^\text{28}\) emphasizes that specific objectives are selected according to the purpose of a learning system being designed and that the purpose of a learning system is learning. According to Mager,\(^\text{29}\) a statement of objectives should specify what task the learner is expected to be able to do, how well he should be able to do it, and under what conditions he should be able to do it.

The measurement of prior attainment is that part in which the instructor determines what the students are already capable of doing or already know. This is usually determined by testing the students and then interpreting the results.\(^\text{30}\)

\(^{27}\)Knirk and Childs, op. cit., p. 43.

\(^{28}\)Banathy, op. cit., p. 24.


\(^{30}\)Stuart R. Johnson and Rita B. Johnson, Developing Individualized Instructional Material (California, 1970), p. 29.
In the selection of learning activities, the instructor is responsible for organizing and providing selected alternatives in the presentation of the material to the students. This is also correct in the arrangement and utilization of media.

If the students are unable to achieve the objectives that have been specified, the system has not achieved its purpose. This fact, along with the constant feedback capabilities built into the systems approach, aids in the evaluation and adjustment of the system.

The systems approach is being recognized more and more as an effective tool for instruction in the classroom. Prominent among those who pioneered this approach is Postlethwait. In an effort to provide an opportunity for his biology students to learn missed work, he developed an audio-tutorial approach that emphasized learning and placed responsibility on the students. He states that the

31 Mager, op. cit., p. 10.
approach has evolved into a multi-faceted, multi-sensory system that exposes the student to logically sequenced material.

Office and business education utilized a systems approach in 1966 in a national curriculum revision feasibility study. The study was entitled New Office and Business Education Learning System. Among the purposes of the project were determining the need and feasibility of a major curriculum revision, developing behaviorally stated goals that are relevant to the office worker, and developing a functional structure or model for curriculum revision. The preliminary work of the study has now been concluded and enactment of the findings and recommendations are beginning to infiltrate the business curriculum.

Lanham states that some of the immediate uses of the implications are a re-examination and re-evaluation of existing programs, behaviorally oriented material is now available for business teacher preparation, and classroom


instructors have basic information for developing and testing behaviorally oriented subject matter. Many of the current research topics in office and business education emphasize the acceptance and application of these implications.

The area currently demanding the most attention is investigation and development of behaviorally oriented objectives. In a task analysis study, Kelly\textsuperscript{38} sought to analyze the tasks performed by semiprofessional accountants. Among the results was a rank-order list of accounting-related tasks. Task analyses of this type represent the basic step to be taken in formulating behavioral objectives. In a similar study in accounting, Petro\textsuperscript{39} investigated the derivation of learning hierarchies and instructional objectives. Implications for developing instructional systems were developed from his findings.


Nelson investigated the effect that specifically stated objectives have on the achievement of students registered in undergraduate economics. The students in the experimental classes were provided with specific objectives (the primary variable) at the beginning of each week. He found that the students in the experimental group achieved a significant statistical difference. In the area of business teacher preparation, Weber developed performance objectives for teacher coordinators in occupational training programs.

To relate behavioral objective research with the systems approach, Calhoun states that

the systems approach provides for consistent and continuing analyses and corrections as succeeding demonstrations provide measurable output in office occupational behavior of individuals involved in learning.

Kopstein points out in agreement that "in an instructional

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system, the sole matter of relevance is the . . . specific performance capabilities of a student."^3

Even though current research topics are concerned with the basic elements of learning systems design (task analysis, behavioral objectives) and considerable previous research, as well as current research, has been conducted involving various components of a learning systems approach (media, instructor, student), very little research exists that involves a complete learning systems approach. The lack of current research involving the systems approach in the area of business education does not mean its importance has been overlooked. Calhoun^4 states that the systems approach is peculiarly relevant to business education.

Johnston^5 analyzed data related to instructional practices in collegiate schools of business. He proposed to use this analysis in the development of an instructional system for collegiate business education. Team

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^4Calhoun, op. cit., p. 46.

^5Russell A. Johnston, "Selected Instructional Practices in Collegiate Schools of Business and Their Use in a Proposed Systems Approach," independent research study, Department of Business Administration and Management, Virginia Commonwealth University, 1967.
teaching, student grouping, teacher assistants, programmed instruction, television, multiple-channel-listening equipment, and simulation were investigated. He concluded that substantial use was being made of the selected instructional practices, but little thought was being given to each of their functions as a component in a systems approach. He further concluded that the classroom and classroom activities would differ in that there would not be the traditional lecture by the instructor other than when it was considered the best component. He also emphasized that the systems approach must be based upon the needs of the student, content, and curricula; not space, arrangement, and facilities.

The remaining research surveyed in business education dealing with a systems approach was not concerned with the instructional level.
CHAPTER III

PROCEDURES FOR COLLECTING AND TREATING THE DATA

This experiment was designed to compare the achievement results for subjects who were using a learning systems approach and subjects who were using the traditional lecture-demonstration-rotation approach. It is essential that the design of the study be understood so that the procedures, findings, and conclusions can be correctly interpreted.

Setting of the Experiment

The study was conducted in the day office machines classes (7 a.m. to 5 p.m.) on two community college campuses in the Fort Worth-Dallas, Texas, metropolitan area during the fall semester, 1971. The two campuses selected are referred to as Campus A and Campus B. Campus A was selected because the administration granted permission to develop and install the learning systems approach in the office machines course taught on Campus A. Support of the project (release time from class instruction, paying for the development of software, purchasing of hardware) was also provided by the administration of Campus A. Campus B was selected because the lecture-demonstration-rotation
approach was utilized at that campus. Other factors influencing the selection of Campus B were similarities to Campus A in philosophy of student admission, similarities in related topics studied and materials used in office machines, similarities in types of machines taught in office machines, and similarities in the amount of time required in the office machines classroom.

Population of the Experiment

The population of the experiment consisted of those students enrolled in the office machines courses taught on Campus A and Campus B during the fall semester, 1971. All students enrolled in office machines on Campus A used the learning systems approach and were placed in Group A. There were four classes assigned to two instructors with a total enrollment of sixty-two students. All students enrolled in office machines on Campus B used the lecture-demonstration-rotation approach and were placed in Group B. There were three classes assigned to one instructor with a total enrollment of sixty-seven students. Instructors for all class sections were appointed in the customary manner by the chairmen of the departments involved.

Instructional Procedures

The office machines courses on Campus A and Campus B required instruction on the ten-key adding machine, the
ten-key printing calculator, and the ten-key electronic calculator. The two groups used the same textbook for classroom practice. The tests coordinated with the textbook were used for evaluation of achievement.

**Learning Systems Approach**

Building materials. — The primary purpose of an office machines course is to develop a marketable skill on office machines. The learning system for Group A (see Figure 1, page 34) was designed and organized around this purpose. Learning packages, one for each machine, were the basic means of guiding instruction. Within each package, small instructional segments specified objectives, listed required activities, reinforced learning, and provided opportunities for self evaluation.

Slide-tape series, one for each machine, were developed to supplement the learning packages in areas such as machine introduction. Machine parts and their uses were especially emphasized in these series.

Eight-millimeter filmloops, four for each machine, were developed to demonstrate machine manipulation and correct psycho-motor movement. The cartridges containing the filmloops limited instructional time for each cartridge to five minutes. Each filmloop was coordinated with a particular segment from one of the packages.
Fig. 1 - The systems model for Office Machines
Practice problems designed to enable a student to develop speed and accuracy were taken from the textbook, *Office Machines Course*,\(^1\) which was a required textbook for the course on both campuses. All ten lessons for each machine were worked by both groups.

The two office machines instructors on Campus A designed and produced the filmloops utilized in this experiment. The following steps were involved in the development of these filmloops. The instructors discussed and decided which concepts should be placed on the filmloops. They then determined how many filmloops would be needed to present the concepts. By analyzing the concepts to be presented by filmloop, they determined that sixteen filmloops would be needed to present the instruction necessary to complete the packages. Eight filmloops were needed for the ten-key printing calculator because of the wide variation in operational controls on the two brands of machines on Campus A.

The next step was to design and write the scripts for each filmloop. For this step, the instructors divided the script responsibilities. Each instructor planned what was to be placed on each filmloop and then prepared the preliminary script. After each script was written, both

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instructors studied the script and made any changes they agreed would be better. Since instructional time was limited to five minutes for each filmloop, the instructors made a final review of each portion of the script for each filmloop. They made any additional changes necessary to keep all filmloops within the five minute time limit.

The script was then typed in final form and prepared for filming. The Media Department of the Learning Resources Center on Campus A became involved in the project at this point. A professional photographer employed by Campus A filmed the instructors at the office machine for each portion of the planned script. Sixteen-millimeter film was used. After the film was developed, the photographer carefully cut and spliced it so that the exact number of seconds needed for each portion was contained in the film. After a final review by the instructors, the film was sent to a company selected to produce the black and white working copy.

When the working copy was returned, the audio portion was recorded for the film. In recording the audio portion, the instructors used a soundproof booth on Campus A. While the working copy was being shown, one of the instructors would read the script and a recording of the audio portion was made so that it could be synchronized with its portion of the filmloop. The film and audio tape were placed on a
Siemens projector. Each portion of the film was shown and marked as each portion of the audio tape was played and marked. Final editing and syncing of the picture and sound track was made.

Both of the copies were then sent to the company selected to cartridge the filmloops. The films were reduced from sixteen-millimeter to eight-millimeter; the sound stripe was attached; and, the final filmloop was inserted into the cartridge.

Orientation and teaching.—Orientation, including familiarization with the learning packages, operation and care of the multi-media and software, and explanation of the model for the systems approach to be used in this study, was accomplished during the first week of the semester. During the orientation, the students were told that the classroom would be open a minimum of eight hours a day. They were also told that an instructor would be available for two hours a day to help with special difficulties and evaluation. A paraprofessional would be available the remainder of the time. The students were not required to meet a specified class session beyond the first week but were required to spend a minimum of three hours a week in the machines room until course requirements were finished. A record of attendance and time spent working in the classroom was maintained by the student.
The first section of the package described the purpose of the packages. The students were given specific objectives for each segment in the learning package. They were also given specific instructions and problems to work in the required activities segment. A self-check was written into the material in the textbook. As each student completed the required activities, he was given an opportunity to take a self-evaluation post-test that had been written into the package. This was different from the self-check in the textbook. The post-test provided an opportunity for the student to evaluate his progress in a particular segment. If his progress did not meet the standards that had been specified in the objectives, he conferred with the instructor and was then directed to repeat portions of the required activities.

When the student had completed all segments of the learning package, he and the instructor set a time for the student to take an examination covering the material in the package. This examination was the one used for measurement of achievement in this study.

The proposed segment entitled Exemption Evaluation was not a part of the system for this study. This component will be included or deleted from the model on the basis of the findings connected with the hypotheses concerning the achievement of students with previous
training or experience and students with no previous training or experience.

The In-Depth segment will eventually become a part of the system, but was not a part during the semester this study was conducted.

**Lecture-Demonstration-Rotation**

In the approach used on Campus B, instruction was conducted in large group demonstrations, in small group demonstrations, and by individual demonstrations. Students were assigned the same practice problems from the textbook required for the course, which was the same as the textbook used on Campus A. A self-check was written into the textbook material. The students were to complete the jobs in the time allowed them in a fixed rotation cycle. There was equal time allotted in the rotation cycle for each machine. Class attendance was compulsory. Students could make up class absences, but were not required to. A record of class attendance was maintained by the instructor; therefore, the students on Campus B were required to record only laboratory use time outside the regular class time. The instructor's record of attendance and the student's record of laboratory use time were combined for total use time.

Upon completion of a cycle on each machine, the student took an examination covering the material studied.
This examination was the one used for measurement of achievement in this study.

Testing Procedures

Achievement

The instruments used for measurement of achievement were three tests, one for each machine, that were coordinated with the textbook used on both campuses. Permission to use the tests accompanying the book, *Office Machines Course*, Fourth Edition, by Cornelia, Pasewark, and Agnew, was requested and granted (see Appendix A). Correspondence with the authors determined that neither validity nor reliability had been established for the tests; however, there were established norms and suggested grading scales.

In order to establish reliability for the tests, all three tests were administered to thirty students on Campus A during the spring semester, 1970. Two weeks later, the tests were readministered to the same students. Pearson Product-Moment Correlation Coefficients were determined for each of the three tests. The correlation coefficient for the Ten-Key Adding Machine, Test 2, was .78; for the Ten-Key Printing Calculator, Test 4, the correlation coefficient was .95; and for the Ten-Key Electronic Calculator, Test 5, the correlation coefficient was .84.
To establish validity, the tests were submitted to a panel of seven judges composed of the following: two senior high school teachers, three community college instructors, and two university professors. All seven were business education teachers with teaching experience ranging from at least five years to more than forty years. All held a minimum of a master's level degree and all were members of Delta Pi Epsilon, an honorary business education fraternity.

Each of the panel members was sent an explanatory letter and response forms (see Appendix B), a copy of all three tests, and a return envelope. They were asked to check whether they thought the tests could adequately determine whether a student could perform machine manipulations involving addition, subtraction, multiplication, and division on a particular machine. Room was also provided for additional comment although comment was not asked for. The tests were to be accepted as valid instruments if five of the seven panel members responded in the affirmative.

All seven panel members returned the response forms after the first mailing. Their responses are summarized in Table I.

Since each of the three tests received more than the designated five votes necessary, each test was accepted
TABLE I
RESPONSE OF SEVEN PANEL MEMBERS REGARDING
VALIDITY OF MEASURING INSTRUMENTS

<table>
<thead>
<tr>
<th>Test</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ten-Key Adding Machine, Test 2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Ten-Key Printing Calculator, Test 4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Ten-Key Electronic Calculator, Test 5</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

as a valid measuring instrument. Upon completion of a
learning package, or at specified times during the rotation
cycle, students were administered the achievement tests
on each of the types of machines included in the study.
The tests were marked and a raw score assigned. The raw
scores were summed for each student in order to arrive at
one achievement score for all three tests. Mean scores
and standard deviations were computed for Group A and
Group B, as well as, for each sub-group of Group A and
Group B.

Intelligence

The Otis Quick Scoring Mental Ability Test was the
instrument used for an intelligence measure. The Gamma
series for high school and college has six equated forms
that are self administering.\(^2\) The established norm for

\(^2\)Arthur S. Otis, Manual of Direction for Gamma Test
adults is a score of 42.\textsuperscript{3} Established reliability coefficients ranging from .88 to .92 have been obtained on the various forms.\textsuperscript{4} The mean validity index of the test items in each form is approximately .50.\textsuperscript{5} One of the suggested applications of the test is to obtain two or more groups of equal mental ability for research purposes.\textsuperscript{6}

To elicit further information required by the hypotheses, the Otis Quick Scoring Mental Ability Test, Gamma series, was administered during the week of the twelfth class day. The scores obtained from the Otis Quick Scoring Mental Ability Test were subjected to a t test to check the equality of the two groups involved in the study. Additionally, the scores were used to sub-group the students for further analysis.

**Attitude**

The instrument used to measure attitude toward office machines was Osgood's Form II format of the semantic differential technique.\textsuperscript{7} Osgood developed the semantic

\begin{itemize}
\item \textsuperscript{3}Ibid., p. 4.
\item \textsuperscript{4}Ibid., pp. 5-6.
\item \textsuperscript{5}Ibid., p. 6.
\item \textsuperscript{6}Ibid., p. 6.
\end{itemize}
differential technique to objectively measure connotative meanings of concepts. Each semantic scale is defined by a pair of polar adjectives that are separated by seven points. The ratings of the subjects are projected as points into what Osgood calls "semantic space." A sample of these spaces is assumed to represent a multi-dimensional space.\(^8\)

In this study, there were twenty scales for each concept. Fourteen were evaluative, three potency, and three active. No standard scales or concepts have been developed for the semantic differential; therefore, they are selected according to the purpose of the research.\(^9\)

Osgood states that "an instrument is valid to the extent that scores on it correlate with scores on some criterion of that which is supposed to be measured."\(^10\) He adds that the semantic differential is an instrument that purportedly measures meaning. Since no commonly accepted independent criterion of meaning is known, validity of the semantic differential has to be based on face validity or those concepts that people would probably cluster together upon administration of the instrument.\(^11\)

\(^8\)Ibid., p. 25.
\(^9\)Ibid., p. 25.
\(^10\)Ibid., p. 140.
\(^11\)Ibid., p. 140-141.
The concepts judged were "Course," "Instruction," and "Usefulness" as they were related to "Office Machines." The scales and polarity of the adjectives were randomly placed in an effort to counteract bias tendencies (see Appendix D).

The reproducibility of scores through a test-retest procedure is considered the proper approach to establish reliability. Therefore, to establish reliability, the semantic differential form used in this study was administered to thirty students registered in the day classes of office machines on Campus A during the spring semester, 1971. A week later, the instrument, with the order of concepts, scales, and descriptive adjectives randomly changed, was readministered. A Pearson Product-Moment Correlation Coefficient of .80 was computed. Average difference between scale positions was obtained for the two test administrations. The adjective pairs with the highest average difference were "low-high" for the concept "Course" and "lenient-severe" on the concept "Usefulness." The average difference for those two adjective pairs was 1.27 scale positions. The adjective pair with the lowest average difference was "meaningful-meaningless" as it relates to "Usefulness." The average difference was .43 scale positions.

\[12\] Ibid., p. 127.
Attitude scores for this study were determined from results of the semantic differential in the following manner:

1. Each scale position of the semantic differential form was assigned a value of "1" for the unfavorable pole to "7" for the most favorable position. A neutral attitude was assigned a value of "4."

2. For use in the computer, raw scores for each scale were converted to $z$ scores.

3. A Pearson Product-Moment Correlation Coefficient for $z$ scores was calculated, yielding a correlation matrix for every scale with every other scale.

4. The intercorrelation matrix was subjected to a principle axis factor analysis followed by a varimax rotation.

5. Scores of the fourteen evaluative scales were recognized as measures of attitude.

6. A factor score was derived with multiple regression techniques using evaluative scores as the criterion.

7. The mean and standard deviation was computed for each adjective pair loaded on the evaluative factor.

Analysis Procedures

The research design utilized for this study was the Posttest-Only Control Group Design illustrated by Campbell
This design is purported to control history, maturation, testing, instrumentation, regression, selection, mortality, and interaction. The involvement of two separate campuses, two different teaching methods, and different instructors made it impossible to meet all requirements for the above seven factors which resulted in variations from the "pure" design as presented by Campbell and Stanley.

Intrasession history was affected since more than one instructor, one time of day, and one combination of days of the week were involved. Maturation and testing were somewhat affected because of the variation in time, since self-pacing was used in Group A and a fixed rotation schedule was used in Group B. The alteration in intrasession history did not affect instrumentation since fixed instruments were used for measurement. The remainder of the seven factors did not appear to be altered by the special circumstances involved in this study.

In this study, the null hypotheses were rejected at the .05 level of significance. The following statistical

\[ R \times O_1 \]
\[ R \times O_2. \]

Donna13 Donald T. Campbell and Julian C. Stanley
methods were used to analyze the data:

1. The \( t \) test was used to determine the significance of the difference in measurement of achievement and time (Hypotheses 1, 3a, 3b, 3c, 4a, 4b, 5, and 7).

2. The relationship of attitude and achievement (Hypotheses 2, 3d, 3e, 3f, 4c, 4d, and 8) and of attitude and average hours (Hypothesis 6) was determined in the following manner:

   (a) Pearson Product-Moment Correlation Coefficients were calculated for the relationships between attitude and achievement and attitude and average hours. Correlation coefficients were calculated separately for Group A, Group B, and the sub-groups.

   (b) The significance of the difference between Group A and Group B or between sub-group subjects for the correlation coefficients was determined by using the \( z \) test for finding the significance of the difference between correlation coefficients. The \( r \)'s were changed into Fisher's \( z \) function by the use of the appropriate table.\(^\text{14}\)

   The standard error of the difference between the two \( z \)'s was determined by the following procedure:

---

The value of $z$ was then determined by the following equation:

$$z = \frac{z_1 - z_2}{SE_z}.$$

The significance of $z$ was determined by consulting the appropriate table.

The results of the statistical treatment are reported in detail in Chapter IV.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The analysis which was employed in this study was divided into four major parts. The first part dealt with the degree of equality between the two groups involved. The second part dealt with a comparison of achievement between the two groups and various sub-groups. The third part dealt with a comparison of classroom use time between the two groups. The fourth part dealt with a comparison of correlations between student attitude and achievement; between student attitude and total use time. All hypotheses were tested in the null form.

Equality of the Two Groups

Two criteria were used to determine how equal or similar Group A and Group B subjects were at the beginning of the experimental procedure. These criteria were intelligence test scores and a numerical comparison of subjects in each group who had previous training or experience on office machines.

During the week of the twelfth class day of the fall semester, 1971, the two groups were administered the Otis
Quick Scoring Mental Ability Test. A t test comparison was performed on the scores obtained from the administration to determine the degree of equality between the two groups. Statistical measures relating to the Otis Quick Scoring Mental Ability Test scores are presented in Table II.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>t</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>44.66</td>
<td>9.42</td>
<td>62</td>
<td>.88</td>
<td>NS</td>
</tr>
<tr>
<td>B</td>
<td>43.07</td>
<td>10.91</td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The obtained t of .88 between the means of the two groups was found not to be significant at the .05 level; therefore, the groups were considered to be not significantly different on the intelligence test criterion.

At the same class meeting in which the intelligence test was administered, a student questionnaire (see Appendix C) was also administered. The data obtained from this questionnaire were used to determine which of the subjects within each group had previous training or experience and which had no previous training or experience on office machines.
A preselected tolerance of four between Group A and Group B subjects who had previous training or experience on office machines had been designated as the acceptable limits. Group A had twenty-five subjects with previous training or experience on office machines while Group B had twenty-three subjects. The variation of two was within the prescribed limits; therefore, the groups were considered to be similar on the previous training or experience criterion.

Achievement

It was hypothesized that the mean of Group A achievement scores would be significantly higher than that of Group B achievement scores. The instruments used for measurement of achievement were three office machines tests, one for each machine used in this study. The tests were coordinated with the textbook used by both groups. Reliability and validity of the three instruments had been determined as a part of this study. Upon completion of a learning package, or at specified times during a rotation cycle, students were administered the achievement test on the machine they were working with. The tests were marked and the correct number of answers determined. One final achievement score for each student was obtained by summing the raw scores on the tests. A mean score and a standard
deviation were computed for each of the groups. A $t$ test was used to determine whether a significant difference between the two groups existed on this variable. Statistical measures relating to achievement test scores for Group A and Group B are presented in Table III.

### TABLE III

**STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ACHIEVEMENT TEST SCORES**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>$t$</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75.53</td>
<td>4.18</td>
<td>62</td>
<td>4.40</td>
<td>&gt;.001</td>
</tr>
<tr>
<td>B</td>
<td>67.94</td>
<td>12.02</td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An examination of the information presented in Table III indicates that the $t$ of 4.40 between the means of the groups is significant at greater than the .001 level. The indicated difference was in favor of Group A. Based upon this evidence, the null hypothesis was rejected and research hypothesis 1 was accepted.

The intelligence test scores obtained from the Otis Quick Scoring Mental Ability Test were used to sub-group Group A and Group B subjects for further analysis. It was hypothesized that Group A sub-group achievement scores would be significantly higher than Group B sub-group achievement scores. The sub-groups were based on the
following divisions. Those subjects whose intelligence test scores were at or above the sixty-seventh percentile were placed in one sub-group. The subjects whose scores were between the sixty-seventh and the thirty-third percentile were placed in another sub-group. The last sub-group was those subjects whose scores were at or below the thirty-third percentile. A mean score and a standard deviation were computed for each of the sub-groups. A t test was used to determine whether a significant difference existed between the Group A sub-groups and the Group B sub-groups on this variable.

Statistical measures relating to achievement test scores for Group A and Group B sub-group subjects whose intelligence test scores were at or above the sixty-seventh percentile are presented in Table IV.

TABLE IV

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ACHIEVEMENT TEST SCORES WHEN SUB-GROUPED AT OR ABOVE THE SIXTY-SEVENTH PERCENTILE

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>t</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>77.15</td>
<td>2.66</td>
<td>20</td>
<td>1.72</td>
<td>NS</td>
</tr>
<tr>
<td>B</td>
<td>74.27</td>
<td>7.03</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An examination of the information presented in Table IV indicates that the $t$ of 1.72 between the means of the subgroups is not significant at the .05 level. Based upon this evidence, the null hypothesis was retained and research hypothesis 4a was rejected.

Statistical measures relating to achievement test scores for Group A and Group B sub-group subjects whose intelligence test scores were between the sixty-seventh percentile and the thirty-third percentile are presented in Table V.

**Table V**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>$t$</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>75.10</td>
<td>4.91</td>
<td>21</td>
<td>1.72</td>
<td>NS</td>
</tr>
<tr>
<td>B</td>
<td>71.50</td>
<td>8.15</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An examination of the information presented in Table V indicates that the $t$ of 1.72 between the means of the subgroups is not significant at the .05 level. Based on this result, the null hypothesis was retained and research hypothesis 4b was rejected.
Statistical measures relating to achievement test scores for Group A and Group B sub-group subjects whose intelligence test scores were at or below the thirty-third percentile are presented in Table VI.

**TABLE VI**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>t</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>74.43</td>
<td>4.27</td>
<td>21</td>
<td>5.28</td>
<td>&gt;.001</td>
</tr>
<tr>
<td>B</td>
<td>58.43</td>
<td>13.24</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An examination of the information presented in Table VI indicates that the t of 5.28 between the means of the sub-groups is significant at greater than the .001 level. The indicated difference was in favor of Group A. Based upon this evidence, the null hypothesis was rejected and research hypothesis 4c was accepted.

An additional sub-group analysis of achievement scores was conducted. Information obtained from the student questionnaire administered at the same time as the *Otis Quick Scoring Mental Ability Test* was used in identifying those subjects who had previous training or experience on office machines and those subjects who had
no previous training or experience on office machines. Group A and Group B subjects were then sub-grouped into the two categories. It was hypothesized that the Group A sub-group subjects would achieve at a significantly higher level than the Group B sub-group subjects. Again, a t test was used to determine whether a significant difference existed between the Group A sub-groups and the Group B sub-groups on this variable.

Statistical measures relating to achievement scores for Group A and Group B sub-group subjects who had previous training or experience on office machines are presented in Table VII.

TABLE VII

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>t</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>76.68</td>
<td>3.06</td>
<td>25</td>
<td>3.01</td>
<td>&gt;.01</td>
</tr>
<tr>
<td>B</td>
<td>70.04</td>
<td>10.55</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The t of 3.01 between the means of the sub-groups is significant at greater than the .01 level. The indicated difference was in favor of Group A. Based on this result,
the null hypothesis was rejected and research hypothesis 4a was accepted.

Statistical measures relating to achievement scores for Group A and Group B sub-group subjects who had no previous training or experience on office machines are presented in Table VIII.

**TABLE VIII**

**STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ACHIEVEMENT SCORES WHEN SUB-GROUPED INTO THOSE WHO HAD NO PREVIOUS TRAINING OR EXPERIENCE ON OFFICE MACHINES**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>t</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>74.76</td>
<td>4.66</td>
<td>37</td>
<td>3.59</td>
<td>&gt; .01</td>
</tr>
<tr>
<td>B</td>
<td>66.84</td>
<td>12.70</td>
<td>44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The obtained t of 3.59 is significant at greater than the .01 level. Again, the indicated difference favored Group A. The null hypothesis was, therefore, rejected and research hypothesis 4b was accepted.

The final analysis of achievement scores did not include the approach to instruction as a factor of division. The subjects were grouped into those who had previous training or experience and those who had no previous training or experience. Information resulting from this comparison was used in determining whether to include the
Exemption Evaluation, or pretest, phase as a part of the systems approach in office machines. It was hypothesized that the achievement scores for the group who had previous training or experience on office machines would be significantly higher than the achievement scores for the group who had no previous training or experience on office machines. A $t$ test was used to determine whether a significant difference existed between the two groups.

Statistical measures relating to achievement scores for those who had previous training or experience on office machines and those who had no previous training or experience on office machines are presented in Table IX.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>$t$</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous</td>
<td>73.50</td>
<td>10.59</td>
<td>48</td>
<td>1.71</td>
<td>NS</td>
</tr>
<tr>
<td>No Previous</td>
<td>70.46</td>
<td>8.25</td>
<td>81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The $t$ of 1.71 indicates no significant difference between the two groups at the .05 level. Based on this result, the null hypothesis was retained and research hypothesis $i$ was rejected.
Classroom Use Time

It was hypothesized that the student use time for Group A would be significantly less than the student use time for Group B. To obtain data to test this hypothesis, a laboratory use notebook was designed for each campus. There was a separate section within each notebook for each of the classes involved on each campus in the experiment. Each student had a time sheet that was placed in alphabetical order in his respective class section.

Campus A used self-pacing; therefore, it was necessary for each student to maintain a record of all the time spent in the classroom. At the end of each week, the time each student spent in the classroom was recorded to the nearest one-fourth hour on a master time card. As the student completed course requirements, the time he spent working in the classroom was totaled. To conform to actual school hours, the time was rounded to the nearest hour.

Campus B used a rotation cycle which made class attendance compulsory. A record of class attendance was maintained by the instructor; therefore, the students on Campus B were required to maintain use time only for the time spent in the classroom other than at the regular class hour. If a student finished the requirements for the rotation cycle before the scheduled completion date, he was excused from class. These excused classes were
deducted from the total hours the same as class absences when total classroom use time was determined. To obtain total classroom use time, the record maintained by the student was combined with the teacher's attendance record. The total was then rounded to the nearest hour to conform to actual school hours. Mean hours and standard deviations were computed for each group. A $t$ test was used to determine whether a significant difference existed between Group A and Group B subjects.

Statistical measures relating to Group A and Group B total classroom use hours are presented in Table X.

**TABLE X**

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B TOTAL CLASSROOM USE HOURS

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>$t$</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>39.02</td>
<td>8.59</td>
<td>62</td>
<td>-4.40</td>
<td>&gt;.001</td>
</tr>
<tr>
<td>B</td>
<td>44.27</td>
<td>4.50</td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A $t$ of -4.40 indicates a significant difference at greater than the .001 level. Group A required fewer hours for course requirement completion than did Group B. Based on this result, the null hypothesis was rejected and research hypothesis 5 was accepted.
Attitude

It was hypothesized that the correlation between attitude and achievement test scores would be significantly higher for Group A than for Group B. The instrument used to measure attitude toward office machines was Osgood's semantic differential technique. The semantic differential is composed of semantic scales, pairs of polar adjectives separated by seven points, that are designed to measure connotative meanings of concepts. In this study, the concepts to be judged were 1. "Course," 2. "Instruction," and 3. "Usefulness" as they were related to "Office Machines." Twenty scales were used for each concept. Fourteen of these scales were evaluative; three, potency; and three, active.

On Campus A, the subjects were administered the semantic differential as they completed course requirements. Approximately two weeks before the end of the semester, the subjects on Campus B were administered the semantic differential. Attitude scores were determined from the results of the semantic differential in the following manner:

1. Each scale position of the semantic differential form was assigned a value of "1" for the unfavorable pole to "7" for the most favorable position. A neutral attitude was assigned a value of "4."
2. For use in the computer, raw scores for each scale were converted to z scores.
3. A Pearson Product-Moment Correlation Coefficient for z scores was calculated, yielding a correlation matrix for every scale with every other scale.
4. The intercorrelation matrix was subjected to a principle axis factor analysis followed by a varimax rotation.
5. Scores of the fourteen evaluative scales were recognized as measures of attitude.
6. A factor score was derived with multiple regression techniques using evaluative scores as the criterion.
7. The mean and standard deviation was computed for each adjective pair loaded on the evaluative factor.

The relationship of attitude and achievement was determined in the following manner. A Pearson Product-Moment Correlation Coefficient was calculated for the relationship between the attitude score of each concept and achievement. Correlation coefficients were calculated separately for Group A and Group B. The significance of the difference between Group A and Group B correlations was determined by the z test for finding the significance of the difference between correlations. The r's for each concept were changed into the z function by the use of the appropriate table.\(^1\) In the table used, the r and

\(^1\)Garrett, op. cit., p. 406.
$z$ at or below .25 were equal. A standard error of difference was computed and the $z$ test applied. Finally, the $z$ scores for each concept were averaged and the $z$ test reapplied to the averaged $z$ scores.

Statistical measures relating to correlations between attitude and achievement scores for Group A and Group B are presented in Table XI.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>$r$</th>
<th>$z$</th>
<th>N</th>
<th>$z$</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-.18</td>
<td>-.18</td>
<td>62</td>
<td>-1.84</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.15</td>
<td>.15</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>-.12</td>
<td>-.12</td>
<td>62</td>
<td>-1.20</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.10</td>
<td>.10</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-.11</td>
<td>-.11</td>
<td>62</td>
<td>-1.67</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.19</td>
<td>.19</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>-.14</td>
<td></td>
<td>62</td>
<td>-1.57</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.15</td>
<td></td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The value of the $z$'s obtained for each of the three concepts, as well as the average, failed to exceed the
required .05 level of significance of 1.96. Based upon these results, the null hypothesis was retained and research hypothesis 2 was rejected.

The intelligence test scores obtained from the Otis Quick Scoring Mental Ability Test were used to sub-group Group A and Group B subjects for further analysis. It was hypothesized that the correlation between attitude and achievement scores for Group A sub-groups would be significantly higher than for Group B sub-groups. The sub-groups were based on the following divisions. Those subjects whose intelligence test scores were at or above the sixty-seventh percentile were placed in the first sub-group. The second sub-group consisted of those subjects whose intelligence test scores were between the sixty-seventh and the thirty-third percentile. The last sub-group consisted of those subjects whose intelligence test scores were at or below the thirty-third percentile. The procedures used for determining the sub-group correlations and z function were the same as those used for the Group A and Group B analysis. The z test was again used for each of the sub-group comparisons to determine whether a significant difference existed between the correlations for each concept and the average.

Statistical measures relating to correlations between attitude and achievement for Group A and Group B sub-groups
whose intelligence test scores were at or above the sixty-seventh percentile are presented in Table XII.

**TABLE XII**

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE AND ACHIEVEMENT TEST SCORE CORRELATIONS WHEN SUB-GROUPED AT OR ABOVE THE SIXTY-SEVENTH PERCENTILE

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>Z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-.15</td>
<td>-.15</td>
<td>20</td>
<td>.49</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.31</td>
<td>-.32</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>.14</td>
<td>.14</td>
<td>20</td>
<td>.12</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.10</td>
<td>.10</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>.19</td>
<td>.19</td>
<td>20</td>
<td>.17</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.13</td>
<td>.13</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>.06</td>
<td></td>
<td>20</td>
<td>.27</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.03</td>
<td></td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The value of the z's obtained for each of the three concepts, as well as the average, failed to exceed the required .05 level of significance of 1.96. Based upon these results, the null hypothesis was retained and research hypothesis 3d was rejected.
Statistical measures relating to correlation
coefficients for Group A and Group B sub-groups whose
intelligence test scores were between the sixty-seventh
percentile and the thirty-third percentile are presented
in Table XIII.

TABLE XIII

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE
AND ACHIEVEMENT TEST SCORE CORRELATIONS WHEN SUB-GROUPED
BETWEEN THE SIXTY-SEVENTH PERCENTILE AND THE
THIRTY-THIRD PERCENTILE

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>Z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-0.00</td>
<td>-0.00</td>
<td>21</td>
<td>-0.67</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.22</td>
<td>0.22</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>-0.12</td>
<td>-0.12</td>
<td>21</td>
<td>-1.19</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.26</td>
<td>0.27</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-0.11</td>
<td>-0.11</td>
<td>21</td>
<td>-1.35</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.32</td>
<td>0.33</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>-0.08</td>
<td>-0.27</td>
<td>21</td>
<td>-1.07</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.27</td>
<td>0.27</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Again, the value of the z's obtained for each of the
three concepts and the average failed to exceed the required
.05 level of significance of 1.96. Based upon these
results, the null hypothesis was retained and research hypothesis 3e was rejected.

Statistical measures relating to correlation coefficients for Group A and Group B sub-groups whose intelligence test scores were at or below the thirty-third percentile are presented in Table XIV.

TABLE XIV

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE AND ACHIEVEMENT TEST SCORE CORRELATIONS WHEN SUB-GROUPED AT OR BELOW THE THIRTY-THIRD PERCENTILE

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-.33</td>
<td>-.34</td>
<td>21</td>
<td>-1.02</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.01</td>
<td>-.01</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>-.22</td>
<td>-.22</td>
<td>21</td>
<td>-.22</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.15</td>
<td>-.15</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-.21</td>
<td>-.21</td>
<td>21</td>
<td>-1.04</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.13</td>
<td>.13</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>-.26</td>
<td></td>
<td>21</td>
<td>-.76</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.01</td>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The value of the z's obtained for each of the three concepts and the average failed to exceed the required .05
Based upon these results, the null hypothesis was retained and research hypothesis 3f was rejected.

An additional sub-group analysis of the correlation between attitude and achievement was conducted. Information obtained from the student questionnaire administered at the same time as the Otis Quick Scoring Mental Ability Test was used in identifying those subjects who had previous training or experience on office machines and those who had no previous training or experience on office machines. Group A and Group B subjects were then sub-grouped into the two categories. It was hypothesized that the correlation between attitude and achievement for Group A sub-groups would be significantly higher than for Group B sub-groups. The procedures used for determining the sub-group correlations and \( z \) function were the same as those used for the Group A and Group B analysis. The \( z \) technique to determine the significant difference between correlations was used.

Statistical measures relating to correlations between attitude and achievement for the Group A and Group B sub-groups who had previous training or experience on office machines are presented in Table XV.

The \( z \) values obtained for each of the concepts and the average failed to exceed the required .05 level of
TABLE XV

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE AND ACHIEVEMENT TEST SCORE CORRELATIONS WHEN SUB-GROUPED INTO THOSE WHO HAD PREVIOUS TRAINING OR EXPERIENCE ON OFFICE MACHINES

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-.02</td>
<td>-.02</td>
<td>23</td>
<td>-1.36</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.38</td>
<td>.40</td>
<td>25</td>
<td>-1.36</td>
<td>NS</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>.07</td>
<td>.07</td>
<td>23</td>
<td>.28</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.02</td>
<td>-.02</td>
<td>25</td>
<td>.28</td>
<td>NS</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-.17</td>
<td>-.17</td>
<td>23</td>
<td>-.97</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.14</td>
<td>.14</td>
<td>25</td>
<td>-.97</td>
<td>NS</td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>-.04</td>
<td></td>
<td>23</td>
<td>-.69</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.17</td>
<td></td>
<td>25</td>
<td>-.69</td>
<td>NS</td>
</tr>
</tbody>
</table>

The z values obtained for each of the concepts and the average in Table XVI were, again, short of the required .05
TABLE XVI

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE AND ACHIEVEMENT TEST SCORE CORRELATIONS WHEN SUB-GROUPED INTO THOSE WHO HAD NO PREVIOUS TRAINING OR EXPERIENCE ON OFFICE MACHINES

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>-.25</td>
<td>-.26</td>
<td>37</td>
<td>-1.36</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.06</td>
<td>.06</td>
<td>44</td>
<td>-1.36</td>
<td>NS</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>-.16</td>
<td>-.16</td>
<td>37</td>
<td>-1.37</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.16</td>
<td>.16</td>
<td>44</td>
<td>-1.37</td>
<td>NS</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-.08</td>
<td>-.08</td>
<td>37</td>
<td>-1.25</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.21</td>
<td>.21</td>
<td>44</td>
<td>-1.25</td>
<td>NS</td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>-.17</td>
<td></td>
<td>37</td>
<td>-1.33</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.14</td>
<td></td>
<td>44</td>
<td>-1.33</td>
<td>NS</td>
</tr>
</tbody>
</table>

level of significance of 1.96. The null hypothesis was retained and research hypothesis 4d was rejected.

A further analysis was conducted involving the correlation between attitude and student use time. It was hypothesized that the correlation between attitude and average hours of use time per student would be an inverse relation and would be significantly higher for Group A than for Group B.
The relationship of attitude and average use hours per student was determined in the following manner. A Pearson Product-Moment Correlation Coefficient was calculated for the relationship between the attitude score of each concept and average use hours per student. The determination of the average use hours per student is explained in the achievement section. The significance of the difference between Group A and Group B correlations was determined by the z test for finding the significance of the difference between correlations.

Statistical measures relating to correlations between attitude and average use hours per student for Group A and Group B are presented in Table XVII.

The values obtained failed to exceed the required .05 level of significance of 1.96. Therefore, the null hypothesis was retained and research hypothesis 6 was rejected.

A final analysis was concerned with the correlation between attitude and achievement scores when the subjects were grouped into those who had previous training or experience on office machines and those who had no previous training or experience on office machines. The approach to instruction used was not a factor in this particular division. Information resulting from this comparison
TABLE XVII

STATISTICAL MEASURES RELATING TO GROUP A AND GROUP B ATTITUDE AND TOTAL CLASSROOM USE HOURS CORRELATIONS

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>.06</td>
<td>.06</td>
<td>62</td>
<td>.15</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.03</td>
<td>.03</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>.12</td>
<td>.12</td>
<td>62</td>
<td>.54</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.03</td>
<td>.03</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>-.04</td>
<td>-.04</td>
<td>62</td>
<td>.08</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>-.05</td>
<td>-.05</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>A</td>
<td>.05</td>
<td></td>
<td>62</td>
<td>.26</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>.00</td>
<td></td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

was used in determining whether to include the instructional exemption, or pretest, phase as a part of the systems approach in office machines. It was hypothesized that the correlation between attitude and achievement scores would be significantly higher for Group A than for Group B. The $z$ test for determining the significance of the difference between correlations was used.

Statistical measures relating to the correlation between attitude and achievement for the previous and
no previous training and experience on office machines are presented in Table XVIII.

**TABLE XVIII**

**STATISTICAL MEASURES RELATING TO ATTITUDE AND ACHIEVEMENT SCORE CORRELATIONS FOR SUBJECTS GROUPED ACCORDING TO PREVIOUS TRAINING OR EXPERIENCE ON OFFICE MACHINES AND NO PREVIOUS TRAINING OR EXPERIENCE ON OFFICE MACHINES**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Group</th>
<th>r</th>
<th>z</th>
<th>N</th>
<th>z</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Previous</td>
<td>-.01</td>
<td>-.01</td>
<td>48</td>
<td>-1.66</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>No Previous</td>
<td>.29</td>
<td>.30</td>
<td>81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Previous</td>
<td>.09</td>
<td>.09</td>
<td>48</td>
<td>.02</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>No Previous</td>
<td>.08</td>
<td>.08</td>
<td>81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Previous</td>
<td>.13</td>
<td>.13</td>
<td>48</td>
<td>.45</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>No Previous</td>
<td>.05</td>
<td>.05</td>
<td>81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>Previous</td>
<td>.07</td>
<td></td>
<td>48</td>
<td>-.39</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>No Previous</td>
<td>.14</td>
<td></td>
<td>81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The z values obtained for this comparison also failed to indicate a significant difference at the .05 level. Therefore, the null hypothesis was retained and research hypothesis 8 was rejected.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The problem of this study was a comparison of two approaches to teaching office machines. The two approaches compared were the learning systems approach and the lecture-demonstration-rotation approach.

The purposes of this study were
1. To determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach to teaching the manipulative skills of office machines on achievement of those skills.
2. To determine the effectiveness of a learning systems approach as compared to the effectiveness of a lecture-demonstration-rotation approach on the attitude of students toward a course in office machines.
3. To analyze student use time for a learning systems approach as compared to student use time for a lecture-demonstration-rotation approach.
4. To determine whether instructional exemption, or pretesting, should be an element of the learning systems approach for office machines.
This study was conducted in the day office machines classes (7 a.m. to 5 p.m.) on two community college campuses in the Fort Worth-Dallas, Texas, metropolitan area during the fall semester, 1971. The learning systems approach was used on Campus A. There were four classes of office machines with a final total enrollment of sixty-two subjects taught by two instructors. The lecture-demonstration-rotation approach was used on Campus B. There were three classes of office machines with a final total enrollment of sixty-seven subjects taught by one instructor.

Two criteria, intelligence test scores and a numerical comparison of those who had previous training or experience on office machines, were used to determine how equal the groups were at the beginning of the experiment. No significant difference was found between the two groups on the intelligence test scores. The number of subjects with previous training or experience on office machines within the two groups were also within the predetermined numerical limitations.

The learning systems approach used on Campus A was designed and organized to enable the students to use self-pacing and self-instruction. Learning packages, slide-tape series, and eight-millimeter filmloops developed and produced by the two instructors on Campus A were the principal sources of instruction. During the semester,
the classroom was open a minimum of eight hours a day. The instructors were in the classroom to assist the students two hours a day. Students were required to work in the lab a minimum of three hours a week until course requirements were completed. They did not have to meet their regularly scheduled class time except to take a formal test. The learning package provided students with an opportunity for self-evaluation and practicing material again. A record of attendance and time spent working was maintained by the student in an attendance record in the classroom. When the students completed a learning package, they took a formal examination to determine their achievement of that particular material.

The lecture-demonstration-rotation approach used on Campus B was designed and organized so that students moved through the course in a fixed rotation cycle. Class attendance was compulsory while lab attendance was not. Upon completion of a cycle on one machine, the student took an examination to determine his achievement on that particular portion of material.

The instruments used for measurement of achievement were three tests, one for each machine, that were coordinated with the textbook used on both campuses. Reliability and validity were determined for each of the three tests. Upon completion of the learning package, or at specified
times during the rotation cycle, students were administered the achievement tests. The tests were checked and raw scores assigned. The raw scores were summed to obtain one achievement score for each student.

The instrument used to measure attitude toward office machines was Osgood's semantic differential. The concepts judged were 1. "Course," 2. "Instruction," and 3. "Usefulness" as they were related to "Office Machines." The attitude score was obtained by a factor analysis.

Various group and sub-group comparisons were made on achievement, attitude, previous or no previous training or experience, and classroom use time. The intelligence test scores and a student questionnaire provided the requisite information for sub-grouping.

The findings of this study tended to support the hypothesis and sub-hypotheses (1, 3a, 3b, 3c, 4a, and 4b) that the learning systems approach will produce a significantly higher level of achievement on office machines than will the lecture-demonstration-rotation approach. Group A, which used the learning systems approach to instruction, achieved at a significantly higher level (greater than .001) than did Group B, which used the lecture-demonstration-rotation approach. However, when Group A and Group B were sub-grouped on the basis of their intelligence test score, no significant difference
was found for the two sub-groups whose scores were at or above the sixty-seventh percentile or for the two sub-groups whose scores were between the thirty-third percentile and the sixty-seventh percentile. There was a significant difference (greater than the .001 level), favoring Group A, between the Group A and Group B sub-groups whose scores were at or below the thirty-third percentile. When Group A and Group B were sub-grouped into those who had previous experience or training on office machines, a significant difference (greater than the .01 level), favoring Group A, was found for each of the comparisons.

The findings of this study supported the hypothesis (5) that the average hours of use time per student in Group A will be significantly less than for the average hours of use time per student in Group B. Group A, using the learning systems approach, used significantly less time (greater than the .001 level) than did Group B, using the lecture-demonstration-rotation approach.

The findings of this study failed to support the hypothesis (7) that those who had previous training or experience on office machines will achieve at a significantly higher level than those who had no training or experience on office machines. When the subjects were divided into
the two categories, with teaching approach not a factor, no significant difference was found.

The findings of this study failed to support the hypothesis and sub-hypotheses (2, 3d, 3e, 3f, 4c, and 4d) that the correlation between attitude and achievement scores would be significantly higher for Group A or Group A sub-groups than for Group B or Group B sub-groups. There was no significant difference for any of the three concepts or the average of the three concepts between Group A and Group B, between Group A and Group B sub-groups based on intelligence test scores, or between Group A and Group B sub-groups based on those who had previous training or experience and those who had no previous training or experience on office machines.

The hypothesis (6) that the correlation between attitude scores and average use hours per student would be an inverse relation and significantly higher for Group A than for Group B was also not supported by the findings of this study. No significant differences were found for any of the concepts or the average of the three concepts.

The hypothesis (8) that the correlation between attitude and achievement scores will be significantly higher for students who have had previous training or experience on office machines than for students who have had no previous training or experience on office machines
was not supported by the findings of this study. Approach to instruction was not a factor in this comparison.

Conclusions

The following conclusions are based upon the findings of this study:

1. Achievement on office machines, especially for the lower ability student, is significantly affected favorably through the use of the learning systems approach to instruction.

2. The self-pacing aspect of the learning systems approach permits students to complete course requirements in significantly less time without achievement being adversely affected.

3. Previous training or experience on office machines does not necessarily enable a student to achieve at a higher level than a student with no previous training or experience on office machines.

Recommendations

As a result of this study, the following recommendations are made:

1. Studies should be conducted to determine the effectiveness of the learning systems approach in other skill and non-skill areas.
2. A study should be conducted in office machines using combinations of components different from those in this study.

3. A study should be conducted in which a combination of the learning systems approach and management by objectives is used as one approach.

4. Additional research should be conducted using the semantic differential as an instrument for measuring change of attitude toward course, instruction, and usefulness.

5. A study should be conducted to determine the difference in final achievement when those who have had previous training or experience on office machines are given pretests and instruction exemption and when those who have had no previous training or experience are required to do all assigned work.

The following recommendations are made for operating the learning systems approach.

1. The learning system must be considered as a whole. The individual components may not be as successful when used separately from the combination of components in the learning system.

2. The role of the instructor in the classroom in which the learning systems approach is used will be to manage learning, to advise, and to help in evaluation of
progress. The conveying of information is just one component and is no longer the instructor's principal responsibility.

3. The Exemption Evaluation, or pretest, should be included as a phase of the learning systems approach.

4. It is essential that an instructor be available to help students with problems or formal evaluation at a specific time daily if self-pacing is used. During the remaining portion of the class day, a laboratory assistant should be available.

5. Media (and the software accompanying it) should be considered as a partner with specific responsibilities. There should not be a duplication of effort by having information conveyed by media and then the instructor presenting the same material again. The instructor would be responsible for elaborating, explaining, or interpreting the material presented by media.
APPENDIX A

Appendix A presents a copy of the letter from South-Western Publishing Company granting permission to use Office Machines Course, Fourth Edition, and the accompanying tests.
May 28, 1971

Mr. Jimmy McKenzie
Tarrant County Junior College
Northeast Campus
828 Harwood Road
Hurst, TX 76053

Dear Mr. McKenzie

In response to your letter of May 12, 1971, we are glad to grant permission for you to use OFFICE MACHINES COURSE, Fourth Edition, and the tests accompanying that item for experimental purposes. It is understood that there shall be no sale of the materials developed in the experiment and if distribution beyond your experimental call should develop you would need to seek further permission.

We wish you well in your study and want you to know that we would be interested in learning of the results.

Sincerely yours

/s/

John L. Pineault
Editor in Chief
Appendix B presents the explanatory letter and response forms sent to the seven panel members asked to evaluate Ten-Key Adding Machine, Test 2; Ten-Key Printing Calculator, Test 4; and Ten-Key Electronic Calculator, Test 5. A description of the seven panel members and their individual responses are also included.
During the Fall Semester, 1971, I will be conducting research in the area of office machines.

In order to conduct my study, I have found it necessary to indicate validity for the attached tests. To indicate validity, a panel of seven judges will be asked to evaluate the following tests:

- Ten-Key Adding Machine, Test 2,
- Ten-Key Printing Calculator, Test 4,
- Ten-Key Electronic Calculator, Test 5.

Would you serve as a member of this panel? If so, please examine each test and indicate whether you think, or do not think, the test will adequately determine whether a student can perform machine manipulations involving addition, subtraction, multiplication, and division. It is important that you indicate Yes or No for each test, not just one.

The names of the seven panel members will not be released. So that I may assure you of anonymity, please do not sign the evaluation sheets. A prompt return of these instruments and your evaluation will certainly be appreciated. If you prefer not to serve as a member of this panel, please check below and return the material to me promptly so that I might select another panel member.

Sincerely,

Jimmy McKenzie

Enclosures

I prefer not to serve as a panel member.
Will this test adequately determine whether a student can perform machine manipulations involving addition, subtraction, multiplication, and division on the Ten-Key Adding Machine?

Yes [ ] No [ ]

Will this test adequately determine whether a student can perform machine manipulations involving addition, subtraction, multiplication, and division on the Ten-Key Printing Calculator?

Yes [ ] No [ ]

Will this test adequately determine whether a student can perform machine manipulations involving addition, subtraction, multiplication, and division on the Ten-Key Electronic Calculator?

Yes [ ] No [ ]
Panel Members

Panel member number one was the chairman of the business department at a large suburban high school. This member had more than forty years teaching experience which included the teaching of office machines.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.

Panel member number two was the coordinator of business education for several high schools in a metropolitan school system. This member had more than ten years teaching experience. Although this member had not taught office machines, the responsibility as coordinator necessitated a familiarity with existing office machines materials and a knowledge of procedures to be used in selecting and evaluating teaching materials.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.

Panel member number three was an office education instructor in a community college. This member had at least five years teaching experience which included office machines instruction.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.
Panel member number four was a business administration instructor in a junior college. This member had more than fifteen years teaching experience which included office machines instruction.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.

Panel member number five was a business education instructor at a community college. This member had at least five years teaching experience which included office machines instruction.

Response: Test 2, No; Test 4, No; Test 5, Yes
No additional comment.

Panel member number six was a business education professor at a university. This member had more than fifteen years teaching experience which included office machines instruction and methods classes that involved studying the teaching of office machines.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.

Panel member number seven was also a business education professor at a university. This member had more than ten years teaching experience which included a methods class which exclusively studied the teaching of office machines.

Response: Test 2, Yes; Test 4, Yes; Test 5, Yes
No additional comment.
APPENDIX C

Appendix C presents the student questionnaire administered during the week of the twelfth class day to solicit information pertaining to previous training or experience on office machines.
STUDENT QUESTIONNAIRE

PLEASE PROVIDE THE FOLLOWING INFORMATION AS ACCURATELY AS YOU CAN

1. Name______________________________

2. Sex  Male______ Female______

3. Marital Status  Single______ Married______

4. Social Security Number ____________

5. Class in college  Freshman______ Sophomore______

6. Have you been taught to use office machines in a previous course in high school or college?  Yes______ No______

7. Check any of the following machines included in this instruction.
   a. Ten Key adding machine ______
   b. Printing calculator ______
   c. Electronic calculator ______
   d. None of these ______

8. Have you worked on a job in which you have used an office machine daily?  Yes______ No______

9. Are you currently working on a job in which you use an office machine daily?  Yes______ No______

10. Check any of the following machines you have used or are currently using daily on the job.
    a. Ten Key adding machine ______
    b. Printing calculator ______
    c. Electronic calculator ______
    d. None of these ______
APPENDIX D

Appendix D presents the semantic differential administered to the students to solicit information pertaining to attitude toward office machines.
SEMANTIC DIFFERENTIAL

INSTRUCTIONS

The purpose of this instrument is to measure the meanings of certain things to various people by having them judge them against a series of descriptive scales. In taking this test, please make your judgments on the basis of what these things mean to you. On each page of this booklet you will find a different concept to be judged and beneath it a set of scales. You are to rate the concept on each of these scales in order.

Here is how you are to use these scales:

If you feel that the concept at the top of the page is very closely related to one end of the scale, you should place your check-mark as follows:


or


If you feel that the concept is quite closely related to one or the other end of the scale (but not extremely), you should place your check-mark as follows:


or


If the concept seems only slightly related to one side as opposed to the other (but is not neutral), then you should check as follows:


or


The direction toward which you check, of course, depends upon which of the two ends of the scale seem most characteristic of the thing you're judging.
If you consider the concept to be neutral on the scale, both sides of the scale equally associated with the concept, or if the scale is completely irrelevant, unrelated to the concept, then you should place your check-mark in the middle space:


IMPORTANT: (1) Place your check-marks in the middle of spaces, not on the boundaries:

THIS
NOT THIS

Sometimes you may feel as though you've had the same item before on the test. This will not be the case, so do not look back and forth through the items. Do not try to remember how you checked similar items earlier in the test. Make each item a separate and independent judgment. Work at fairly high speed through this test. Do not worry or puzzle over individual items. It is your first impressions, the immediate "feelings" about the items, that we want. On the other hand, please do not be careless, because we want your true impressions.
lenient: lenient
meaningless: meaningless
progressive: progressive
important: important
complete: complete
wise: wise
hard: hard
low: low
graceful: graceful
free: free
dirty: dirty
bad: bad
passive: passive
painful: painful
simple: simple
sociable: sociable
false: false
dark: dark
beautiful: beautiful
cold: cold
severe: severe
meaningful: meaningful
regressive: regressive
unimportant: unimportant
incomplete: incomplete
foolish: foolish
soft: soft
high: high
awkward: awkward
constrained: constrained
clean: clean
good: good
active: active
pleasurable: pleasurable
complex: complex
unsociable: unsociable
true: true
light: light
ugly: ugly
hot: hot
OFFICE MACHINES USEFULNESS

lenient
meaningless
progressive
important
complete
wise
hard
low
graceful
free
dirty
bad
passive
painful
simple
sociable
false
dark
beautiful
cold

severe
meaningful
regressive
unimportant
incomplete
foolish
soft
high
awkward
constrained
clean
good
active
pleasurable
complex
unsociable
true
light
ugly
hot
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