

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A COMPARISON OF TWO METHODS OF STRUCTURING BUSINESS
MACHINES CLASSES FOR ADULTS IN A COMMUNITY COLLEGE

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

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Norman, Oklahoma

1977

A COMPARISON OF TWO METHODS OF STRUCTURING BUSINESS
MACHINES CLASSES FOR ADULTS IN A COMMUNITY COLLEGE

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Dedicated to My Parents:

JACK AND CORA DURHAM

ACKNOWLEDGMENTS

The writer wishes to express sincere and grateful acknowledgment to all of the individuals who helped make this study possible.

A very special note of thanks and appreciation is extended to Dr. Eugene F. Cates, Committee Chairman, for his continued kindness, understanding, counseling, and encouragement.

Appreciation is also expressed to the other members of the committee, Dr. Billie Holcomb, Dr. Herbert Hengst, and Dr. Loy Prickett for their assistance and interest in the accomplishment of this study.

The writer would like to acknowledge the support given by the Seminole Junior College administration, the Board of Regents, and my colleagues in making this study possible.

A special recognition and appreciation is extended to my daughter, Jana, for her understanding and patience throughout my doctoral program.

Final appreciation is expressed to my parents to whom the writer is forever indebted. Without their assistance, encouragement, confidence, sacrifices, love, and baby-sitting this writer's educational goal would never have been attained.

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CHAPTER I

INTRODUCTION AND PROBLEM

Both public and higher education have come under fire in recent years because of strict rules and regulations governing the students. Compulsory attendance is one of these regulations that has been criticized. Required attendance has been based on the assumption that exposure to teaching is highly related to student learning.

In the spring of 1971, Temple University law students mounted a vigorous protest against compulsory class attendance. They referred to the attendance requirements as "Mickey Mouse," and teachers were becoming more aware of student feelings and student power.

Jenne compared the academic achievement attitudes, and overall grade point average (GPA) of Temple University junior and seniors enrolled in a college health science course.

Each student was presented with a list of specific course objectives in the form of study questions. Class sessions were largely devoted to discussion of these study questions, but also included consideration of unrelated questions raised by students. Not all study questions were discussed in class; little time was devoted to formal

lecture. The students were informed at the beginning of the course that they were free to attend or cut class as they wished.

A pretest-posttest instrument that had previously been developed for the same course, over the same questions and for similar groups of students was then given. As a means of determining proficiency change which would control specific abilities with which the students entered the course, residual gain scores were computed from pre- and posttest z scores. Residual gain scores represent the deviations of the obtained final scores from the scores predicted by the pretest, and are well suited for use in correlational analysis with other variables also calculated as z scores. Jenne found the results to be somewhat astonishing. Class attendance correlated .799 with proficiency gain on the test. At the conclusion of the study Jenne commented, "I was forced to conclude that given this course in health science, my students and me as the teacher, class attendance is important."¹

In a somewhat similar study, Caro compared the achievement and dropout rated among two groups of 335 college students at the University of Tennessee. One group was required to attend classes, while the other group was

¹Frank H. Jenne, "Attendance and Student Proficiency Change in a Health Science Course," Journal of School Health, Vol. 53, No. 2, (February, 1973), pp. 125-127.

allowed to attend on a voluntary basis. The criterion of achievement was performance on a 100-item multiple-choice test administered to each group as a final examination. Caro found no significant difference in performance between those who were required to attend class and those who were not. Furthermore, the relation between dropouts and treatment groups was not significant.²

There are some obvious questions raised by the results of these two studies. First, does compulsory class attendance improve academic achievement? If so, is such an improvement a result of the poorer students dropping out of the course? Does compulsory attendance create poor attitudes among students? Do students at any age level achieve at a faster rate if they are required to attend class? If so, can achievement be facilitated through a combination of self-teaching techniques and required class attendance? These are the primary and secondary questions which were investigated in this study.

Definition of Terms

Several terms were used in the study which must be defined. It should be noted, however, that the definitions offered were intended only for this study and were not an

²Paul W. Caro, Jr., "The Effect of Class Attendance and 'Time Structured' Content on Achievement in General Psychology," Journal of Educational Psychology (Vanderbilt University, 1962), Vol. 53, No. 2, pp. 76-80.

attempt to state universal definitions.

Adults/Students: Adults enrolled in Business Machines classes (Secretarial Science 2223) at Seminole Junior College during the spring semester of the 1976-77 academic year.

Compulsory-Attendance Classes: Those students who were enrolled in Business Machines classes and who had to attend all class periods until they became proficient on all business machines taught in the course. A warning slip was sent on the fourth absence and a dismissal notice was sent on the seventh absence.

Voluntary-Attendance Classes: Those students who were enrolled in Business Machines classes but were allowed to attend classes on a voluntary basis and who were exempt from the policy of being warned and/or dismissed after the sixth absence. Both groups were instructed by individually-paced methods supplemented with some lectures. All participants were allowed to discontinue class attendance once they became proficient on all business machines taught in the course.

Business Machines Classes: Individual course offerings as a part of the Secretarial Science Program offered by Seminole Junior College.

Students' Progression Rates: The number of hours spent in class and laboratory work during each week of the semester necessary to complete each machine.

Students' Attitudes: The students' attitudes concerning various aspects of the Business Machines course, the course instructor and teaching practices, and equipment and facilities as determined by their responses to the Students' Evaluation Questionnaire presented in the Appendices.

Student Achievement: Adult students' scores as taken from the proficiency tests administered in conjunction with each of the four business machines taught in the Business Machines course and scores from job assignments completed in the textbook (Appendices A and B). Each proficiency test was based on the knowledge and skills gained through the completion of specific problems assigned from the textbook before the students were allowed to take the proficiency tests.

Students' Ability Level: The level of ability as indicated by participants' Math and composite scores from the American College Test (ACT).

Students' Manual Dexterity: Participants' level of finger (manual) dexterity as measured by their performance on the Finger Dexterity Board of the General Ability Testing Battery (GATB).

Students' Previous Experience: The amount of previous experience with the business machines used in teaching the Business Machines course as indicated by the adults' responses to the Level of Experience Questionnaire presented

in the Appendices.

Community College: The community college is a public two-year educational institution that attempt to meet postsecondary educational needs of its local community. It also may be referred to as a public junior college or a public community junior college. Its functions usually include: (1) the transfer or college parallel program, and (2) the nontransfer program which consists of technical education, vocational education, general education, and continuing education. In this study, the term community college was used in reference to a specific community college--Seminole Junior College, Seminole, Oklahoma.

Statement of the Problem

The purpose of this study was to compare the effects of two different methods of structuring introductory business machines classes on the achievement ant attitudes of students at Seminole Junior College. This study was designed to compare the achievement, attitudes, progression rates, and completion rates of adults who voluntarily attended individually-paced business machines classes with the achievement, attitudes, progression rates, and completion rates of adults who were required to attend individually-paced business machines classes at Seminole Junior College.

Need for the Study

Requiring students to attend class is usually based on the assumption that the students' opportunities to learn are enhanced through their interaction with the instructor and other students in the classroom setting. The argument that teachers can instruct only those students who are present would appear to be irrefutable. Therefore, a mandatory class attendance policy is justified as a means of promoting interaction between and among students and teachers, thus enhancing the students' success record. This reasoning may be particularly appropriate for junior colleges since their open admission policies attract a more heterogeneous group of students who may lack the degree of self-discipline or academic ability found among students in institutions with selective admission requirements.

On the other hand, attendance in class is not the only way in which learning occurs. Students may learn without ever attending any scheduled class sessions as is evidenced by many successful correspondence courses. Those opposing compulsory attendance may argue that it is an infringement upon students' rights to choose and become more responsible for themselves.

Another argument against compulsory attendance is that whenever people are forced to do anything, there is usually a certain degree of resistance. Resentment and unrest may

occur when adult students are required to adhere to any type of strict policy. Also, if a student is failing, he may prefer to be dismissed from class for lack of attendance than receive an "F." In this way, he could blame his failure on the institution instead of himself.

This study was designed to yield objective evidence concerning a compulsory attendance policy. It is apparent that class attendance is not the only factor influencing attitudes toward a class or academic achievement and this study does not intend to resolve the question as to whether mandatory attendance is desirable in all situations.

The results of this study may be useful to adult educators who are trying to determine whether to require class attendance in certain junior college courses. Such policies are usually mandated by administrators of institutions, but it is typically the instructors who must cope with the students' attitudes and achievement. The possibility exists that they may be enforcing a policy that makes no difference in student achievement.

Null Hypotheses to be Tested in the Study

In order to accomplish the purposes of the study and explore the research questions stated earlier, the following hypotheses were tested for significance:

- Ho₁ There is no statistically significant difference between the achievement rates

of adults in the voluntary-attendance Business Machines classes and the achievement rates of adults in the compulsory-attendance Business Machines classes.

- Ho₂ There is no statistically significant difference between the attitudes of adults in the voluntary-attendance Business Machines classes and the attitudes of adults in the compulsory-attendance Business Machines classes.
- Ho₃ There is no statistically significant difference between the progression rates of adults in the voluntary-attendance Business Machines classes and the progression rates of adults in the compulsory-attendance Business Machines classes.
- Ho₄ There is no statistically significant difference between the completion rates of adults in the voluntary-attendance Business Machines classes and the completion rates of adults in the compulsory-attendance Business Machines classes.

Limitations of the Study

The first limitation of the experiment lay in the size of the two groups used in the study. Each class was limited to twenty-five (N=25) students. The population of participants was limited to the adults enrolled in the Business Machines classes at Seminole Junior College during the spring semester of the 1976-77 school year.

A second limitation to the study was the lack of a norm-referenced testing instrument for assessing the students' achievement. The instruments used were criterion-referenced materials published by a reputable textbook

company whose primary concern is providing books for business courses taught at high schools and colleges.

A third limitation to the experiment was the number and type of machines used in teaching the course. These machines were as follows: (1) Monroe ten-key adding machines with printed tape results, (2) Adler electronic printing calculators, (3) Monroe electronic printing calculators, and (4) Monroe display calculators.

A fourth limitation of the study was in the experimental treatment. Compulsory attendance did not mean forced attendance, but that there were no excused absences. Because of this, and because some participants were unable to attend classes at times, the researcher needed to control the attendance variable carefully by recording the amount of time spent on each machine in order to receive maximum effects from the experimental treatment.

Summary

This study was in no way designed to prove or disprove the importance of class attendance. Its main objective was to present evidence as to the differences in attitudes and achievement of students who were required to attend class as compared to those students who were allowed to attend class voluntarily.

The purpose of the study was to compare the achievement, attitudes, progression rates, and completion rates of

students attending classes voluntarily with those students who were required to attend. Achievement was measured by administering achievement tests after the completion of each type of business machine. A one-way analysis of covariance was used to compare the achievement of the two groups so other variables such as manual dexterity, ability levels, previous experience, and accessibility to the business machines could be controlled.

A one-way analysis of covariance was used to compare the pretest-posttest attitude change scores taken from the Students' Evaluation Questionnaire and to test the progression rates or number of class hours needed to reach proficiency.

The percentage in each group completing the course was compared by using a Chi Square (X^2).

The general outline of this experiment includes presenting the definition of terms, the statement of the problem, the need for the study, the null hypotheses to be tested, and the limitations of the study in Chapter I. Chapter II provides a review of related literature, and Chapter III contains a description of the overall design of the study.

The data and the analysis of the data are presented in Chapter IV and the final chapter contains a summary of the findings, the conclusions, and the recommendations for future studies.

CHAPTER II

REVIEW OF RELATED RESEARCH

It is commonly accepted that absenteeism or lack of attendance is one reason why adults fail to achieve their objectives in adult education. In order to profit from educational opportunities, the adult must participate in the learning experience. Adults are usually not compelled to enroll in classes nor are they forced to attend them after they decide to enroll.

Since adult education is a voluntary activity, the decision to participate or not rests with the individual adult and is influenced by factors that are components of both the personality and the social group life of the individual involved. Such personal independence in the matter of participation complicates the administrative function, frustrates the adult educator, and inhibits achievement of the maximum effective role of adult education in society.¹

Concern over adult participation or attendance is not new. According to Verner and Newberry, "In 1814, Thomas Pole recommended that 'conductors' of adult classes visit the homes of those adults absenting themselves from classes."²

Virtually every aspect of adult education revolves around participation and persistence of attendance,

¹Coolie Verner and John S. Newberry, Jr., "The Nature of Adult Participation," Adult Education, VIII (Summer, 1958), p. 208.

²Ibid.

yet the quality of substantial research related to this particular aspect of the field is astonishingly small and inadequate. No other aspect of adult education so badly needs systematic and creative basic research.³

Since class attendance, whether it be voluntary or involuntary, is so vital to the learning process, it is evident that college administrators and faculty should seek ways to improve it. The question is, of course, how can it be improved? Does an instructor have the right to penalize a student or lower his grade for absenteeism? Is it possible for the administration to impose strict rules and regulations regarding student attendance? Or is it possible that an adult student would succeed in a non-compulsory attendance program where he could progress at his own pace and time?

Compulsory Attendance

Tradition points out the view that attendance is so important to student achievement that it should be mandatory. This belief has led to strict rules and regulations set by college administrators and instructors governing attendance. This has brought about student discontent and strife even during the days of the early colonial colleges in America.

³ Coolie Verner and George S. Davis, Jr., "Completions and Dropouts, A Review of Research," Adult Education, (Spring, 1964), p. 173.

Reinforced paternalism, strict obedience, and over-regulation of students resulted in student rebellions, presidents being tarred and feathered, buildings being burned, and real damage and personal harm inflicted upon individuals.

Although ensuing years saw a relaxing of rules and regulations, the early eighteenth century colleges were plagued with rowdiness, vandalism, and riot-rebellions of savage dimensions. The faculty and administration exercised strict and explicit controls. Still later, athletics and social-fraternity groups displaced the literary societies. Academic work had become such a drag that these spirited activities were not only substitutes for but were actually escapes from the main enterprise of the college or university--formal learning for its own sake.⁵

There is little evidence of student activism after the Civil War. Crane gives the following reasons for this calmness.⁶

- (1) The elective system was introduced
- (2) Faculty began to accept students as young adults
- (3) Coeducation

He also names three other calming influences:

⁴Robert M. Crane in Louis C. Vaccaro and James Thayne Covert (eds.), Student Freedom in American Higher Education, (Columbia University: Teacher College Press, 1969), p. 54.

⁵Ibid., p. 56.

⁶Ibid., p. 58.

- (1) The development of athletics and fraternities
- (2) The introduction of special policing forces and hiring policing proctors, preceptors, and residence staff
- (3) The land-grant college movement, which established so-called people's universities all across the nation

In the late nineteenth and early twentieth centuries, deans of student life were appointed whose concerns were and still are with the students' personal, social, recreational, and spiritual life, to say nothing of the efforts they made to establish guidelines, rules, and regulations within student governance and freedom areas.⁷

Since World War II, students have begun to assume more and more responsibilities for their own affairs out of class. Part of this may be due to the fact that college students are older, especially junior college students. The average age of junior college students has gradually increased to around 25 years. At Seminole Junior College the average age is 29 years.

The demonstrations, sit-ins, and riots of the 1960's again focused attention on students' rights and freedoms. They cried for "relevance" in courses, more voice in student governance, and for various other freedoms in campus life.

It has been recalled to our minds more vividly during

⁷Ibid., p. 59.

last year's Bicentennial of the American Revolution that it usually takes "radicals" or "activists" to bring forth much needed changes in our society. There is no denying that student rights and freedoms should be the utmost concern of every faculty and administrator in every college and university. The problem is: How much freedom should there be--or how much can our students handle?

In 1965, Howe wrote that:

The more mature and more capable students now coming from high schools don't need their learning measured out . . . in coffee spoons. They will achieve on their own, more quickly than the usual course makes possible, levels of understanding that ready them for more advanced work.

The least we could do is allow students to cut classes so they can pursue learning on their own. A person who has acquired the invaluable capacity to do this doesn't need to waste time on excessive spoon-feeding in the company of less capable peers.

Six or eight years from now the colleges will be confronting a new group of students with more dependable habits of learning and greater capacity to work independently.⁸

Many students enter today's colleges later in life after dropping out earlier or after simply postponing their college education for various reasons. A number of these late comers have failed to develop the appropriate self-discipline required to achieve a college education. Jobs, children, family responsibilities, finances, and many other

⁸ Harold Howe, II, "Out Colleges Aren't Ready for Today's Students," Saturday Review, Vol. 28, (May 15, 1965), p. 77.

factors only compound the situation making it easier to discontinue a course.

These adults or "new" students as they are referred to in current literature, are the unemployed, the developmentally disabled, senior citizens, fulltime employed, parolees, women, and the underemployed.⁹ In recent years they have enrolled by the thousands in junior colleges across the nation. They have also dropped out in great numbers.

The junior colleges have long been criticized for their high attrition rates. Medsker and Tillery report that "for public two-year colleges as a group, second-year enrollment tends to be less than half of first-year enrollment, thus suggesting more than a 50 percent attrition rate."¹⁰ They do state, however, that there are at least some valid reasons for this which are no reflection on the junior colleges.

Many students transfer to a four-year college before completing two years in a community college. Of even greater significance is the fact that students often remain in the community college until they have satisfied some personal or vocational need and then leave to pursue employment or other activities. The fact that they do not remain for two years is not of

⁹Young Park, "A Conceptual Basis for Nontraditional Study," Community and Junior College Journal, (March, 1976), Vol. 26, No. 6, p. 29.

¹⁰Leland L. Medsker and Dale Tillery, Breaking the Access Barriers, (New York: McGraw-Hill Book Company, 1971), p. 49.

itself cause for criticism, especially if the community college is viewed as a flexible institution capable of serving various types of needs.¹¹

Nevertheless, many adults who enroll in junior college programs fail to achieve their expected goals and desires. Love reports that "90 percent of students fail to achieve the goals for which they came."¹² Preston says that only 4 percent of them do.¹³ Those goals most often listed are encompassed by the following categories: preparation for advanced study, career education and guidance, developmental services, and community services.¹⁴

In 1973, the Seminole Junior College adopted a new absentee policy. It is the same one used for the required attendance class in this study. On the fourth absence the student is warned he is in danger of being dropped from class. On the seventh absence, he is dropped. He cannot be reinstated without special permission from the dean.

The JUCO Journal, Seminole Junior College's monthly newspaper, printed some of the students' reactions to this

¹¹ Ibid., p. 51.

¹² Robert A. Love, "A Call for Action," School and Society, Vol. LXX (October, 1949), p. 31.

¹³ James M. Preston, "The Study of Continuing and Non-Continuing Adult Students," (Unpublished dissertation, University of California, Berkeley, 1958), p. 78.

¹⁴ Gale Jensen, A. A. Liverright, and Wilbur Hallenbeck, Adult Education, Adult Education Association of the U. S. A., 1964, pp. 12-13.

policy:

The new absentee policy at Seminole Junior College has drawn quite a bit of disapproval from the few students I have talked to:

"We pay to come to school here so we should be able to come when we want."

"As long as I keep my grades up, it shouldn't make any difference when or how much I come to class."

"The policy is too strict because it treats you like a child instead of an adult."¹⁵

In discussing "freedom" and student governance, Crane contends that:

. . . guidelines must be given to every member of a college or university if equal freedom is to be made available to all. Through governance, then, the basic laws are created from which guidelines for profitably functioning in a community can be drawn up.¹⁶

All writers on the subject, pro and con, seem to agree on one thing. More research on the subject is needed; more innovative techniques should be utilized to make education a more pleasant, rewarding experience for students of all ages.

Whittmer says:

It is interesting that in a "free" country most parents allow the coercive dispossession of their

¹⁵Mike Auld, "Absentee Policy Judged," JUCO Journal, Vol. V., No. 6, (January 31, 1974), p. 2.

¹⁶Robert M. Crane, op. cit., p. 50.

children for 12 years of state-sponsored and formulated education without complaining.¹⁷

Also, Brown contends that:

. . . too many classrooms are loaded with students who have no interest in learning but are there because of either parental or societal pressure. High school students are entitled to an education but should not be forced to acquire one; and it is now clear that time is running out on compulsory education.¹⁸

Hansen argues that:

Compliance and conformity have incorrectly been equated with educational success achieved by the child. The development of the child, through a display of interpersonal respect and mutual integrity, will significantly be enhanced when externally imposed behavioral standards are minimized and the qualities of uniqueness and creativity are prized as conformity and compliance have been in the past.¹⁹

Hansen quotes Hentoff as saying, "Students want their constitutional rights and the artificial and compulsory behavioral standards, arbitrarily imposed, might strongly violate these rights."²⁰

Millard, a proponent of compulsory attendance, presents an entirely different point of view.

When a youngster elects to quit school before formal completion, he is in effect removing himself from a potential lifetime income officially

¹⁷Joe Wittmer in Merrell Hansen, "Sacred Cows: The Compulsory Elements of Schooling," Educational Leadership, (March, 1974), p. 514.

¹⁸Ibid.

¹⁹Ibid.

²⁰Ibid.

estimated at \$165,000 for the high school graduate. A 16- or 17-year-old youngster simply may not comprehend the enormity of such a decision, or he may not possess the maturity of judgment to understand fully his own life situation, enabling him to arrive at such a decision intelligently. Such a youngster needs intensive guidance and counseling. The dropout may be a person with serious personality and environmental conflicts rather than an immature person who simply decides to walk away from his responsibilities.

Even a cursory review of the statistics bears this out: The unemployment rate among dropouts is double that of the general population; they are also out of work for longer periods; dropouts are identified as that hard core of uneducated young people who perform the menial and routine work tasks.

Taking this further, in terms of upward strivings, some writers have suggested that social mobility is becoming less and less possible in America. When one considers the growing unemployment rate, especially among youthful workers, in the ranks of a diminishing unskilled labor class, it almost suggests that as class affiliation goes, we are probably witnessing the emergence of an "economically disaffiliated class" in the economic structure of a super-scientific America.

Within this framework, the central problem for public education is one of developing an imaginative and far-reaching curriculum with bold new concepts in teaching and with new techniques and devices for the prevention and/or holding of dropouts.²¹

Voluntary Attendance

Hansen describes the tradition of compulsory attendance

²¹Thomas L. Millard in Harold Full(ed.) Controversy in American Education, (London: Collier-McMillan Limited, 1967), pp. 239-240.

as a "sacred cow" in education; one that needs changing, but is hardest to change. He writes:

Perhaps the least logical and easiest compulsory school element to modify is the administrative and organizational structure of the schools. However, this has remained amazingly resilient to change despite the need for change.

Many elements in the schools have a compulsory aura about them. These are sacred and traditional cows, surviving as historical appendages, nonfunctional and disabling. These compulsory anachronisms need not be revered or worshipped simply because they have endured. They serve as reminders that the schools have been coercive and compelling toward the student and teachers to learn, to behave, and to achieve uniformly . . . educators must not continue their unexamined lives and the perpetuation of practices so obviously disharmonious to today's needs and tomorrow's requirements.²²

Few studies are available comparing student achievement and attitudes in voluntary and compulsory situations. Smiley²³ compared the performance of high school freshmen biology students taught by the audio-tutorial method who were allowed to attend voluntarily with the performance of students who were required to attend. His study, completed in 1973, indicated that those who attend voluntarily performed just as well as those who were required to attend.

²²J. Merrell Hansen, op. cit., p. 515.

²³Curtis Lee Smiley, "A Comparative Study of Compulsory vs Non-Compulsory Attendance in Secondary Biology Using the Systems Approach to Biology Program as the Method of Teaching," (Unpublished dissertation, Purdue University, 1973).

Also, in 1973, Taylor²⁴ found no significant difference in achievement, attitude, or class behavior when he divided 84 high school juniors into two groups requiring one group to attend and allowing the other group to attend class voluntarily.

In 1974, Ellzy²⁵ compared the achievement and opinions of students at Northern Illinois University in college level office practice and office machines classes. One office practice class and one office machines class were instructed by individualized learning method while the other office practice class and office machines class were instructed by group-lecture type method.

The control group (lecture-type method) was required to attend class and the experimental group (individualized learning method) was allowed to attend class on a voluntary basis. The classroom procedures for the traditional, lecture-type classes consisted of lecture, demonstration, and assigned rotation by the instructor. The experimental, individualized group were given instruction sheets and were allowed to progress at their own rate of speed.

²⁴Darrel Dean Taylor, "A Study of the Relationship Between Time and Learning: A High School Optional Attendance Program," (Unpublished Ed.D. dissertation, University of Southern California, 1973).

²⁵James A. Ellzy, "A Comparison of Two Methods of Teaching Office Practice and Office Machines at the Collegiate Level," (Unpublished dissertation, Northern Illinois University, 1974).

There were no significant differences found in the achievement or opinions of the control and experimental groups. However, it was found that it may take less time to complete a course if students are allowed to achieve at their own pace. It should be pointed out that this was a university study where students live in dormitories and are on campus the entire week and are readily available for classes. The results might have been different if the study had been performed at a commuter junior college where students drive many miles to attend class.

Templeton reports that "there is little research evidence to support or refute the contention that class attendance is more regular or academic achievement is greater if attendance is required."²⁶ In 1975, he did a study dealing with two groups of students at Vincennes University, a comprehensive junior college in Indiana.

Templeton compared the academic achievement of 24 classes divided into two groups each. These two classes had the same instructor and course content. One group was required to attend class and the other could attend voluntarily. Academic achievement was measured by scores on objectively-scored comprehensive final examinations.

²⁶Ralph Doles Templeton, "An Investigation of Some Effects of Required and Voluntary Attendance Policies at One Junior College," (Unpublished dissertation, Faculty of the School of Graduate Studies, Indiana State University, 1975).

For the twelve pairs of classes, the instructors provided records of class attendance and the final raw achievement score.

He found that in only one pair of classes achievement was higher when attendance was required; in eleven pairs of classes the differences were not significant; although six pairs of classes with voluntary attendance excelled. However, among all students a significant attendance-achievement correlation was found when scholastic aptitude was held constant.

CHAPTER III

METHODS AND PROCEDURES

The experiment began with twenty-six ($N=26$) students enrolled in the Business Machines class designated as the compulsory-attendance class and twenty-eight ($N=28$) students enrolled in the Business Machines class designated as the voluntary-attendance class. During the course of the experiment, thirty-eight ($N=38$) students completed the course and acted as subjects to determine the effects of class attendance policies based on their class performance and attitudes. One group, the compulsory-attendance group ($N=22$), was required to attend all regularly scheduled classes and laboratory sessions. A second group, the voluntary-attendance group ($N=16$), was allowed to attend as many or as few regularly scheduled classes and laboratory sessions as they pleased. The two groups' achievement, attitudes, rates of progression, and completion rates were compared to test four hypotheses.

The methods and procedures used in conducting the experiment are presented in this Chapter. They are divided into four time segments: (1) the pre-experimental procedures, (2) experimental procedures, (3) data collection procedures, and (4) data analysis procedures. Each of these

areas of methodology is considered in this Chapter.

Pre-Experimental Procedures

The pre-experimental procedures consisted of all those tasks which the researcher needed to complete before the actual collection of the data began. The most important of these tasks are described in the following sections.

Choice of Research Design

The first pre-experimental procedure was to choose the proper research design for the conduct of the study. The words "research design" are intended to mean the plan, structure, and strategy of investigation conceived to obtain answers to research questions and to control external sources of variation. The Plan is the overall scheme or program of the evaluation problem; the Structure is the more specific structure or paradigm of the actual manipulation of the independent variables being controlled; and the Strategy as used here is even more specific than the structure--it is the actual methods used in the gathering and analysis of the data.

A research design serves two basic purposes: (1) it provides answers to research questions posed by the investigator; and (2) it controls external sources of variation (independent variables). In other words, it is through the design of a study that research is made

effective and interpretable. Kerlinger makes the following statement in regard to research and evaluation designs:

How does design accomplish this? Research designs set up the framework for 'adequate' tests of the relations among variables. The design tells us, in a sense, what observations (measurements) to make, how to make them, and how to analyze the quantitative representations (data) of the observations. Strictly speaking, design does not 'tell' us precisely what to do, but rather suggests the directions of observation making and analysis, how many observations should be made, and which variables (independent variables) can then act to manipulate (control) the active variables and to dichotomize or trichotomize or otherwise categorize the assigned variables. A design tells us what type of statistical analysis to use. Finally, an adequate (proper for the particular situation) design outlines possible conclusions to be drawn from the statistical analysis (parentheses material added).¹

The research design chosen for the present experiment was a two-sample true experimental design preceded by the sampling of participants from two finite populations. A paradigm of this research design is presented in Figure 1.

Rogers² indicates that after choosing the hypotheses which we wish to test, and the instruments most suitable for their operational measurement, the next step is to decide on the method to use in getting the information we need. The research design that Rogers felt to be most effective in most experimental situations was the

¹Fred N. Kerlinger, Research, (New York: Holt, Rinehart, and Winston, Inc., 1973), pp. 120-161.

²Wilson Rogers, Designing Experiments, (New York: The MacMillan Co., 1974), pp. 120-161.

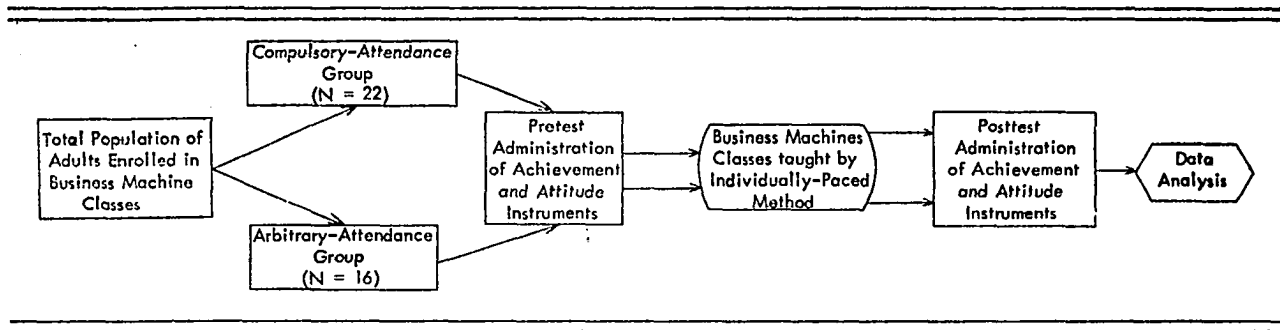


Figure 1. Example of Research Design Used in the Experiment.

pretest-posttest control group design. This was one of the major reasons for choosing the design used in the present study.

A second reason for choosing the design shown in Figure 1 was its use in previous studies. In a survey conducted by the Journal of Educational Research of thirty-eight different and independent studies concerning different teaching methodologies, eighty-five percent (85%) of the studies used a pretest-posttest design.

One criticism of the design shown in Figure 1 is that it tends to propagate the Hawthorne Effect.³ The Hawthorne Effect is an experimental effect resulting from the participants' extra effort and superior performance simply because they know they are part of the experiment.⁴ While such an effect will probably occur in the present study, student groups should receive equal amounts of the phenomenon, and the overall effects of the Hawthorne Effect will be controlled by the same-to-all principle.⁵

Selection of Instruments for Measuring Students' Achievement

The researcher measured the two groups' level of

³D. T. Campbell and Julian C. Stanley, "Experimental and Quasi-Experimental Designs for Research," in Handbook of Research on Teaching, (New York: Rand McNally and Co., 1962), pp. 37-110.

⁴M. T. Orne, "The Hawthorne Effect in Educational Research," Phi Delta Kappan, 44, 1962, pp. 116-122.

achievement as they proceeded through the Business Machines course. Achievement was measured by administering proficiency tests at various times during the course. Students were required to pass proficiency tests related to both psychomotor skills in using the business machines and in knowledge about the machines' capabilities. Examples of these proficiency tests are included in Appendix A.

The Instrument Used for Measuring Students' Attitudes

An instrument for measuring the students' attitudes was developed for the study. After considering several alternatives, an instrument similar to that developed and standardized by Amyx⁶ was adapted to the present study. This instrument, shown in Appendix C has four areas of evaluation questions: (1) Evaluation of the Course (nine statements), (2) Evaluation of the instructor and teaching practices (eleven statements), (3) Evaluation of equipment and facilities (two statements), and (4) Suggestions for improving the Business Machines classes.

This instrument was selected because the items in it appear to sufficiently cover the areas which needed to be

⁵Ibid.

⁶Jack Amyx, "Determining the Effects of Two Methods of Teaching Accounting on the Attitudes and Achievement of College Students," (unpublished doctoral dissertation, Oklahoma State University, Stillwater, Summer, 1976).

measured in the proposed study. Also, it was found that the instrument could be confined to one page and students could complete it with little effort within a ten-minute period. Since no attempt was made to disguise items and there was nothing in the content to suggest threatening or incriminating self-disclosure by respondents, the researcher believed the respondents would answer honestly the items on the instrument. The questions were selected as a result of an attempt to collect data on factors related to attitudes and opinions of students concerning a specific course; therefore, it was hoped that the questions were sufficiently comprehensive.

Items 1 through 9 under Evaluation of Course on the Students' Evaluation Questionnaire were designed to test Hypothesis 2 in this study.

Items 1 through 11 under Evaluation of Instructor and Teaching Practices were added for the information of the researcher but were not pertinent to the results of this study.

At the bottom of the questionnaire students were asked to circle one or more suggestions that would help them get more out of the course. Items 4 and 6 were included to test Hypothesis 2 regarding students' attitudes on voluntary and required attendance.

Reliability

Amyx determined the test-retest reliability of the rating instrument as ranging from $r = .830$ to $r = .914$. These values are significant beyond the .001 level for studies having 15-25 subjects in each group. To further test the reliability of the instrument the researcher gave the questionnaire to a class of twenty-five students enrolled in a Business Communications course at Seminole Junior College. The test-retest reliability coefficient over a two-week interval was .91. For a group of 25 students, .47 to .54 would be sufficient.

Validity

Amyx determined the validity of the data collection instrument by comparing students' ratings with an established criterion, the Guttman Scale. Results of this comparison showed the validity as ranging from .661 to .780.

A second measure of validity was taken by having a panel of four instructors give an opinion as to the instruments validity. The panel agreed on the content validity of the instrument, although no index was computed.

To test the construct validity of the instrument used in this study, the researcher used the known-groups method.⁷

⁷M. Rokeach, The Open and Closed Mind, (New York: Basic Books, 1960), pp. 197-203.

"In this method, groups of people with 'known' characteristics are administered an instrument. For example, if we were validating an attitude scale designed to measure conservatism, we might select groups 'known' to be very conservative, and groups 'known' not be conservative."⁸

Five faculty members at Seminole Junior College were asked to choose five students "known" to have a positive attitude toward a certain class and five students who were "known" to have a negative attitude toward the same class. They were then asked to administer the Students' Evaluation Questionnaire used in this study to those students. A product-moment correlation coefficient was used to relate the criterion measures with measures recorded by sample students. The construct validity was determined to be .67.

The Students' Evaluation Questionnaire was then submitted to the Doctoral Committee Chairman to determine its adequacy for the present study. After minor changes, the instrument shown in Appendix C was selected for use in the study.

Control of Relevant Extraneous Variables

It was necessary to control all identifiable extraneous variables which could cause differences in the participants'

⁸Fred N. Kerlinger, Foundations of Behavioral Research, (New York: Holt, Rinehart, and Winston, Inc., 1973), p. 467.

performances. These variables were:

- (1) previous experience with the machines used in the course
- (2) manual (finger) dexterity
- (3) level of ability
- (4) present access to machines similar to those used in the Business Machines classes
- (5) previous coursework
- (6) race
- (7) grade point average
- (8) marital status
- (9) sex

There were no significance differences in the ages of the two groups; therefore, age was not entered into the equation as a covariable. The effects of most of these variables could have been controlled by random selection of participants, but this was not possible because of the limited numbers of the two classes. It was necessary for the experimenter to control the effects of the different variables by alternate methods.

The participants' previous coursework, level of experiences and proficiency with the machines used in the course were controlled by having them complete the questionnaire shown in Appendix D. Students' responses from this questionnaire were treated as covariables in the statistical analysis procedures.

Manual dexterity was controlled by administering the

Finger Dexterity Subtest of the General Ability Testing Battery (GATB), Participants' scores from this test were treated as covariables in the statistical analysis.

Another variable to be controlled was the participants' ability levels. Level of ability was determined by the students' math ACT scores, composite ACT scores, and grade point average. These data were used to adjust each participants' achievement scores when the analysis of covariance was calculated. Also treated as covariables in the statistical analysis were the participants' sex, marital status and race.

Previous coursework was the final variable which had to be controlled, since it was possible that similar courses taken prior to the experiment may have expedited some participants' achievement more than others. The questionnaire in Appendix D was used to determine the participants' previous coursework experiences.

Selection of Participants

The adult/students who participated in the experiment were the adults enrolled in Business Machines Classes (Secretarial Science 2223) at Seminole Junior College during the spring semester of the 1976-77 academic year. At that time, there were two such classes at Seminole Junior College. One of these was designated the Compulsory-Attendance Class and the other was identified as the

Voluntary-Attendance Class. There were approximately twenty-five (N=25) adults enrolled in each class at the beginning, but some students dropped out.

These two classes were chosen because they were repetitive practice type courses in which supervised practice is more necessary than classes in social studies or other areas. Regular Attendance in Business Machines classes could possibly benefit the students since they probably would not have access to all the different types of machines anywhere except in the classroom.

Description of Business Machines Used
in Course Secretarial Science 2223

There were four types of business machines used in teaching the Business Machines Course. These four were as follows:

- (1) Monroe ten-key adding machines with printed tape results
- (2) Alder electronic printing calculator
- (3) Monroe electronic calculator
- (4) Monroe electronic display calculator

Both voluntary and compulsory attendance classes were administered the Attitude Questionnaire and the Level of Previous Experience Questionnaire at the beginning of the experiment. Next, the students began regular class and laboratory sessions as part of their Business Machines training. Class sessions were structured mainly around a

system of preliminary orientation and introduction to the business machines followed by practice and the completion of assigned learning exercises. These exercises were intended to acquaint the students with the machine's functions, capabilities, and limitations.

There was a great deal of individually-paced instruction involved in the Business Machines course. Once students had been introduced to the various business machines and received their assignment sheets, they were allowed to proceed at their own pace through the assigned exercises. The textbook provided specific step-by-step instruction and examples for completing assigned jobs. The instructor was available to assist students during regularly scheduled class periods and also during regular office hours. Once they had completed all job assignments and passed the knowledge and proficiency tests associated with one machine, students were allowed to proceed to the next machine until proficiency had been reached in the utilization of all units. If a student failed the proficiency test, (a grade below 70%) he or she had to study the areas missed and take a similar test over the same material covered in the first test.

Data Collection

Several measures were recorded for each student during the course of the experiment. First, the participants'

math and composite ACT scores were taken from their cumulative records. Next, the finger dexterity subtest of the General Ability Testing Battery (GATB) was administered in order to determine the students' level of manual dexterity. Students' progression rates were determined by recording the number of class hours needed to reach proficiency with each machine.

Students' completion rates were determined by calculating the percentage of students who finished the course as opposed to the number who were enrolled at the beginning.

Students' attitudes were determined by comparing pretest-posttest change scores taken from the Attitude Questionnaire.

Data Analysis Procedures

Once the data had been collected, they were analyzed to determine whether there were any differences between the various scores recorded for students in the compulsory and voluntary attendance classes.

The first, second, and third hypotheses were tested by comparing the final achievement grades, attitude change scores, and completion time scores assigned to members of the two classes. At the same time, however, the effects of other variables such as manual dexterity, ability levels, previous experience, and accessibility to the business machines had to be controlled. A one-way analysis of

covariance was used to make the necessary comparison and control the effects of the additional variables at the same time.

The fourth null hypothesis was tested by comparing the completion percentage calculated for the voluntary attendance class with the completion percentage calculated for the compulsory attendance class. A chi square (χ^2) test was used to compare the two percentages.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

In the present study, fifty-four college students enrolled and thirty-eight completed a Business Machines course at Seminole Junior College during the spring semester of the 1976-77 school year. These students acted as subjects to determine the effects of compulsory and voluntary attendance on the participants' achievement, progression rates, attitudes and completion rates. Participants were required to gain proficiency on four business machines before they could complete the self-paced teaching program. The effects of several extraneous variables were controlled in the study through the use of an analysis of covariance testing statistic. The covariables controlled were as follows:

- (1) Previous experience with business machines
- (2) Manual dexterity
- (3) Math ACT scores
- (4) Composite ACT scores
- (5) Present access to the machines or similar machines
- (6) Previous coursework
- (7) College grade-point average
- (8) Sex

(9) Race

(10) Marital Status

This Chapter contains the results of the data analysis. Each hypothesis is considered individually and in chronological order, with a summary of each hypothesis and the overall results presented at the end of the Chapter.

Preliminary Analysis

It was necessary to perform some preliminary analysis of the data before the hypotheses were tested. This analysis involved determining the relationships (correlations) between the covariable measures and the four dependent measures taken during the study. The following codes were used to enter the data on IBM cards:

- (1) Previous experience
Yes = 1
No = 2
- (2) Manual dexterity
actual values
- (3) Math ACT scores
actual values
- (4) Composite ACT scores
actual values
- (5) Access to machines
Yes = 1
No = 2
- (6) Previous coursework
Yes = 1
No = 2
- (7) Grade-point average
actual values

- (8) Sex
 - Male = 1
 - Female = 2
- (9) Race
 - White = 1
 - Black = 2
 - Indian = 3
- (10) Marital status
 - Married = 1
 - Single = 2

The codes assigned to the dependent measures taken in the study were as follows:

- (1) Achievement
 - Raw score values
- (2) Attitude
 - Average ratings
- (3) Time needed to complete course
 - actual hours
- (4) Completion rates
 - Yes = 1
 - No = 2

The data were analyzed by using a one-way analysis of covariance testing statistic. This statistic is part of a prewritten package of statistical programs currently operational at the University of Oklahoma's Merrick Computer Center.

The analysis of covariance is a testing statistic which is designed to control the effects of independent variables which cannot be controlled in any other way. Through statistical calculations based on a linear regression model, dependent measures are adjusted in direct proportion of their degree of relationship with the measure being taken.

For instance, if there is a strong relationship between the IQ scores (the covariable) and the achievement scores (dependent variable) of two groups of students and the overall average IQ of the two groups is significantly different, individual achievement scores will be adjusted until they represent the achievement which could be expected if the two groups' IQ scores had been exactly the same. The final results of analysis of covariance (ANCOVA) procedures is that it allows the researcher to eliminate the effects any independent variable may have on the measures being taken. In the present study, the two groups were equated on the independent variables of:

- (1) Previous experience
- (2) Manual dexterity
- (3) Math ACT scores
- (4) Composite ACT scores
- (5) Present access to similar machines
- (6) Previous coursework
- (7) Grade-point average
- (8) Sex
- (9) Race
- (10) Marital status

In other words, any differences in the two groups' achievement scores that may have been caused by these ten covariables were eliminated as a result of the analysis of covariance procedures.

All statistical analysis were performed on a 360-70 IBM computer at the Merrick Center. A summary of the descriptive statistics and the correlations computed between the variables is presented in Table 1.

Results of Testing Null Hypothesis Number One

The first null hypothesis tested is restated in the following format.

- Ho₁ There are no statistically significant differences between the achievement rates of student adults in the compulsory-attendance Business Machines class and the achievement rates of student adults in the voluntary-attendance class.

The first null hypothesis was tested by comparing the two groups' achievement test scores. The calculated mean values and the adjusted mean values of the two groups' achievement test scores are presented in Table 2.

A one-way analysis of covariance was used to make the comparison, with the ten covariables shown in Table 1 being controlled during the statistical calculations. The results of the statistical analysis are presented in Table 3.

The results presented in Table 3 show that there was a significant difference between the compulsory-attendance group's achievement scores and the voluntary-attendance group's achievement scores ($F = 15.710$; $df=1/35$; $p < .01$). These results allowed the researcher to reject the first null hypothesis

TABLE 1
 INFORMATION CONCERNING THE COVARIABLES CONTROLLED IN THE STUDY
 AND THEIR RELATIONSHIP TO THE DEPENDENT MEASURES TAKEN

	Compulsory Attendance Group (N = 22)	Voluntary Attendance Group (N = 16)	DEPENDENT VARIABLES			
			Achievement	Attitude	Time needed to complete	Number who finished course
PREVIOUS EXPERIENCE	yes = 0% no = 100%	yes = 29% no = 71%	- 0.171	- 0.143	- 0.311	- 0.453
PRESENT ACCESS TO MACHINES	yes = 27% no = 73%	yes = 29% no = 71%	- 0.411	- 0.443	- 0.214	0.153
PREVIOUS COURSEWORK	yes = 27% no = 73%	yes = 36% no = 64%	- 0.214	- 0.223	0.110	0.153
MANUAL DEXTERITY	$\bar{X}$ = 94.36 S = 18.40	$\bar{X}$ = 88.00 S = 17.45	0.153	- 0.032	- 0.426	0.137
MATH ACT SCORES	$\bar{X}$ = 14.29 S = 6.75	$\bar{X}$ = 12.20 S = 7.24	0.614	0.513	- 0.033	- 0.114
COMPOSITE ACT SCORES	$\bar{X}$ = 14.43 S = 4.61	$\bar{X}$ = 12.40 S = 5.42	0.706	0.499	- 0.107	- 0.092
GRADE-POINT AVERAGE	$\bar{X}$ = 2.572 S = 0.87	$\bar{X}$ = 2.123 S = 0.772	0.443	0.171	- 0.032	- 0.113
SEX	M = 82% F = 18%	M = 38% F = 62%	- 0.034	0.206	- 0.319	- 0.193
MARITAL STATUS	M = 95% S = 5%	M = 44% S = 56%	- 0.213	- 0.347	0.173	- 0.422
RACE	White = 81% Black = 5% Indian = 14%	White = 62% Black = 13% Indian = 25%	- 0.221	- 0.150	0.317	- 0.183

TABLE 2
MATHEMATICAL MEAN VALUES AND ADJUSTED MEAN VALUES OF
PARTICIPANTS' OVERALL ACHIEVEMENT TEST SCORES

	Students In Compulsory Attendance Classes (N = 22)	Students In Voluntary Attendance Classes (N = 16)
Calculated Mean Value	$\bar{X} = 89.00$	$\bar{X} = 87.50$
Standard Deviation	$S = 6.810$	$S = 7.763$
Adjusted Mean Values*	$\bar{X} = 91.28$	$\bar{X} = 85.23$
Adjusted Standard Deviation*	$S = 5.164$	$S = 4.229$

*The covariables controlled in the study were; previous experience with business machines, manual dexterity, ACT scores, present access to similar machines, previous coursework, grade-point average, sex, race, and marital status.

TABLE 3
RESULTS OF THE ANALYSIS OF COVARIANCE COMPARING THE
TWO GROUPS' OVERALL ACHIEVEMENT SCORES

Source of Variation	Degrees of Freedom	Adjusted Mean Squares	F-Value	Significance Level
Between Groups	1	49.602	15.710	$p < .01$
Within Groups	35	3.157		
TOTAL	36			

Visual examination of the two groups' adjusted mean values in Table 2 will show that students in the compulsory-attendance class made significantly higher achievement gains than students in the voluntary-attendance class.

Results of Testing Null Hypothesis Number Two

The second null hypothesis tested is restated in the following format:

Ho₂ There is no statistically significant difference between the pretest-posttest attitude change scores of students in the compulsory-attendance class and the pretest-posttest attitude change scores of students in the voluntary-attendance class.

The second null hypothesis was tested by comparing the students' pretest-posttest change scores taken from the Students' Evaluation Questionnaire. The calculated mean values and the adjusted mean values of the two groups' attitude change scores are presented in Table 4.

A one-way analysis of covariance was used to make the statistical comparison, with the ten covariables shown in Table 1 being controlled through the statistical calculations. The results of the statistical analysis are presented in Table 5.

The results presented in Table 5 indicate that there was a significant difference between the compulsory-attendance group's attitude change scores and the voluntary-attendance group's attitude change scores ($F = 5.086$; $df=1/35$; $p < .05$).

TABLE 4
MATHEMATICAL MEAN VALUES AND ADJUSTED MEAN
VALUES OF PARTICIPANTS' PRETEST-POSTTEST
ATTITUDE CHANGE SCORES

	Students In Compulsory Attendance Classes (N = 22)	Students In Voluntary Attendance Classes (N = 16)
Calculated Mean Value	$\bar{X} = 0.246$	$\bar{X} = 0.495$
Standard Deviation	$S = 0.590$	$S = 0.567$
Adjusted Mean Value*	$\bar{X} = 0.217$	$\bar{X} = 0.567$
Standard Deviation*	$S = 0.443$	$S = 0.493$

*The covariables controlled in the study were; previous experience with business machines, manual dexterity, ACT scores, present access to similar machines, previous coursework, grade-point average, sex, race, and marital status.

TABLE 5
RESULTS OF THE ANALYSIS OF COVARIANCE COMPARING THE TWO
GROUPS' PRETEST-POSTTEST ATTITUDE CHANGE SCORES

Source of Variation	Degrees of Freedom	Adjusted Mean Squares	F-Value	Significance Level
Between Groups	1	6.174	5.086	$p < .05$
Within	35	1.214		
TOTAL	36			

These results allowed the researcher to reject the second null hypothesis.

Visual examination of the two groups' adjusted mean values in Table 2 shows that the voluntary-attendance group made significantly greater attitude gains than students in the compulsory-attendance group.

Results of Testing Null Hypothesis Number Three

The third null hypothesis is restated and tested in the following format:

Ho₃ There are no statistically significant differences between the amount of time needed by students in the compulsory-attendance class to complete the coursework and the amount of time needed by students in the voluntary-attendance class to complete the coursework.

The third null hypothesis was tested by comparing the average number of hours each group's students needed to complete the coursework. Actual class times were recorded by the class instructor. The calculated mean values and the adjusted mean values of the two groups' average times are presented in Table 6.

A one-way analysis of covariance was used to make the statistical calculations and to control the results of the covariables shown in Table 1. The results of the calculations are presented in Table 7.

The results presented in Table 7 show that there was not a significant difference between the amount of time needed

TABLE 6
MATHEMATICAL MEAN VALUES AND ADJUSTED MEAN VALUES OF THE TIMES
NEEDED FOR PARTICIPANTS TO FINISH THE COURSE

	Students In Compulsory Attendance Classes (N = 22)	Students In Voluntary Attendance Classes (N = 16)
Calculated Mean Value	$\bar{X} = 37.636$	$\bar{X} = 37.375$
Standard Deviation	$S = 8.516$	$S = 10.072$
Adjusted Mean Value*	$\bar{X} = 35.140$	$\bar{X} = 38.229$
Standard Deviation*	$S = 9.278$	$S = 9.163$

*The covariables controlled in the study were: previous experience with business machines, manual dexterity, ACT scores, present access to similar machines, previous coursework, grade-point average, sex, race, and marital status.

TABLE 7
RESULTS OF THE ANALYSIS OF COVARIANCE COMPARING THE AMOUNTS
OF TIME THE TWO GROUPS NEEDED TO FINISH THE COURSE

Source of Variation	Degrees of Freedom	Adjusted Mean Squares	F-Value	Significance Level
Between Groups	1	6.179	1.042	$p > .05$
Within Groups	35	5.930		
TOTAL	36			

by students in the compulsory-attendance class to complete the coursework and the amount of time needed by students in the voluntary-attendance class to complete the coursework ($F = 1.042$; $df=1/35$; $p > .05$). These results would not allow the researcher to reject the third null hypothesis.

Results of Testing Null Hypothesis Number Four

The fourth null hypothesis is restated and tested in the following format:

H_{04} There is no statistically significant difference between the completion rates of adults in the compulsory-attendance class and the completion rates of adults in the voluntary-attendance class.

The fourth null hypothesis was tested by comparing the percentage of students who enrolled in the compulsory-attendance class and completed the course with the percentage of students who enrolled in the voluntary-attendance class and completed the course. The numbers of students who enrolled, the number who finished, and the completion percentages for the two groups are presented in Table 8.

A Chi Square Test was used to compare the completion percentages of the two groups. The results of the calculations are presented in Table 8.

The results presented in Table 8 show that there was a significant difference between the percent of the

TABLE 8
A COMPARISON OF THE COMPLETION RATES EXPERIENCED BY PARTICIPANTS
IN THE COMPULSORY AND VOLUNTARY ATTENDANCE CLASSES

	Compulsory Attendance Classes (N = 22)	Voluntary Attendance Classes (N = 16)
NUMBER ENROLLED	26	28
NUMBER COMPLETED	22	16
PERCENT OF COMPLETION	84.62	57.14
$\chi^2 = 5.327; df = 1; p < .05$		

compulsory-attendance group who completed the course and the percent of the voluntary-attendance class who completed the course ($\chi^2 = 5.327$; $df=1/35$; $p < .05$). These results allowed the researcher to reject the fourth null hypothesis.

A visual comparison of the completion percentages of the two groups indicates that there was a significantly higher percentage of the compulsory-attendance group who completed the course than the voluntary-attendance group.

Ancillary Findings

The major issue investigated in this study was the issue of compulsory class attendance for college students. The results of testing null hypothesis number four showed that the students enrolled in the compulsory-attendance class had a much higher completion rate than students enrolled in the voluntary-attendance class. However, the researcher was more interested in the participants' actual opinions of the attendance requirements. These opinions were solicited in two areas of the Students' Evaluation Questionnaire.

First, the eighth statement on the evaluation instrument read as follows: "Class attendance procedures." Students were asked to make a rating of 1-9 concerning their opinion of each area. Results of these ratings by the two groups were as follows:

Compulsory-Attendance Group

$\bar{X} = 8.667$

Voluntary-Attendance Group

$$\bar{X} = 7.313$$

These results indicate that the compulsory-attendance was very much in favor of the compulsory-attendance program while the voluntary-attendance group was very much opposed to the voluntary-attendance procedures.

A second method for determining the participants' opinions of the class attendance procedures was through having them indicate the way(s) they felt would help them get more out of the Business Machines Course. The results of the two groups' posttest ratings on the Students' Evaluation Questionnaire are presented in Table 9.

The participants' ratings presented in Table 9 show that twenty-four percent (24%) of the students in the voluntary-attendance class felt that student attendance should be required. On the other hand, none felt that student attendance should be voluntary. Moreover, this was the most frequent suggestion made by the attendance group.

The compulsory-attendance group made no suggestions about attendance, but felt that a stronger background in mathematics would help them get more out of the course. Both groups indicated a need for a wider variety and more advanced business machines.

Summary of Results

Four null hypothesis were tested for significance at the .05 level in the present study. Three of the null

TABLE 9
SUGGESTIONS FOR COURSE IMPROVEMENT AS MADE BY THE TWO
GROUPS AFTER THE EXPERIMENT HAD BEEN CONDUCTED

Suggestions Made	Compulsory Attendance Group (N = 22)	Voluntary Attendance Group (N = 16)
1. More Class periods	0%	16%
2. Fewer class periods	18%	0%
3. More practical applications	9%	4%
4. Required student attendance	0%	24%
5. Wider variety of machines	27%	16%
6. Voluntary student attendance	0%	0%
7. More advanced business machines	9%	20%
8. A stronger background in mathematics	37%	20%
TOTALS . . .	100%	100%

hypotheses could be rejected, while one could not. The results of testing these hypotheses may be summarized as follows:

Students in the compulsory-attendance class made significantly higher achievement gains than students in the voluntary-attendance class.

Students in the voluntary-attendance class made significantly greater attitude gains than students in the compulsory-attendance class.

There were no significant differences between the amounts of time the two groups needed to complete the coursework.

There was a significantly higher percentage of the compulsory-attendance class who completed the coursework than the voluntary-attendance class.

Ancillary findings showed that both the compulsory- and voluntary-attendance groups felt that attendance should definitely be required in future Business Machines courses. Class attendance procedures were given the highest ratings by the compulsory-attendance group and the lowest ratings by the voluntary-attendance group.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

Summary

The purpose of this study was to compare the effects of two different methods of structuring introductory business machines classes on the achievement and attitude of students at Seminole Junior College. This study was designed to compare the achievement, attitudes, progression rates, and completion rates of adults who voluntarily attended individually-paced business machines classes with the achievement, attitudes, progression rates, and completion rates of adults who were required to attend individually-paced business machines classes at the community college.

During the course of the experiment, fifty-four college students enrolled and thirty-eight students completed a Business Machines course at the community college during the spring semester of the 1976-77 school year and acted as subjects to determine the effects of compulsory and voluntary attendance on the participants' achievement, progression rates, attitudes, and completion rates. One group, the compulsory-attendance group, was required to

attend all regularly scheduled classes and laboratory sessions. A second group, the voluntary-attendance group, was allowed to attend as many or as few regularly scheduled classes and laboratory sessions as they pleased.

Participants were required to gain proficiency on four business machines before they could complete the self-paced teaching program. The effects of several extraneous variables were controlled in the study through the use of an analysis of covariance testing statistic. The co-variables controlled in the study were as follows:

- (1) Previous experience with business machines
- (2) Manual dexterity
- (3) Math ACT scores
- (4) Composite ACT scores
- (5) Present access to the machines or similar machines
- (6) Previous coursework
- (7) College grade-point average
- (8) Sex
- (9) Race
- (10) Marital status

Four null hypotheses were tested for significance at the .05 level in the present study. Three of the null hypotheses could be rejected while one could not.

Conclusions

On the basis of the evidence presented in this study, the following conclusions appear to be justified.

- (1) Students in the compulsory-attendance class made significantly higher achievement gains than students in the voluntary-attendance class.
- (2) Students in the voluntary-attendance class made significantly greater attitude gains than students in the compulsory-attendance class. The adjusted mean value for the voluntary-attendance class was .567 while the compulsory-attendance class was only .217.
- (3) There were no significant differences between the amounts of time the two groups needed to complete the coursework.
- (4) There was a significantly higher percentage of the compulsory-attendance class who completed the coursework than the voluntary-attendance class.

These findings seem to concur with Kowalski's statement: "Even in these times when in loco parentis is becoming a discredited principle and talk of complete student freedom is in vogue, it seems apparent that the university must continue to guide the academic and personal development of all students."¹

The correlation between attendance and achievement found in this study disagrees with the findings in

¹Casimir John Kowalski, "Comparison of Persisting and Nonpersisting Students at Indiana University," (unpublished dissertation, Indiana University, Ed.D., 1975), p. 93.

Templeton's study² mentioned in Chapter II to some extent. In only one pair of classes out of twelve was achievement higher when attendance was required. However, he did find that there was a significant correlation between achievement and attendance when scholastic aptitude was held constant.

Taylor's³ and Ellzy's⁴ studies comparing attitudes and achievement of students who attended voluntarily with those who were required to attend showed no significant differences in achievement or attitudes.

The results of this study are in agreement, however, with those of Jenne⁵ when he found a high correlation between attendance and achievement.

Ancilliary findings showed that both the compulsory- and voluntary-attendance groups felt that attendance should definitely be required in future Business Machines courses.

²Ralph Doles Templeton, op. cit.

³Darrel Dean Taylor, op. cit.

⁴James A. Ellzy, op. cit.

⁵Frank H. Jenne, op. cit.

Composite ACT scores, math ACT scores, and grade-point average were significantly correlated with achievement in the Business Machines classes. Also, two of these covariables, math ACT scores and composite ACT scores, had a moderately high correlation with the students' attitudes; while the covariable, grade-point average, had a low correlation with the students' attitudes.

The other student characteristics, previous experience, manual dexterity, present access to machines, previous coursework, sex, race, and marital status were unrelated to the dependent variables, achievement, attitude, time needed to complete the course, and the number completing the course.

When the students were asked to make suggestions for course improvement, the following was revealed.

Item 1: More Class Periods. None of the students in the compulsory-attendance class felt that more class periods were needed while 16 percent of the voluntary-attendance class suggested more class periods. This could have occurred because most of the compulsory-attendance class (84.62%) persisted with relatively few absences until they finished the course while the voluntary-attendance class may have procrastinated and the semester slipped by too rapidly to complete the course. Only 57 percent of the voluntary-attendance class finished.

Item 2: Fewer Class Periods. Not any of the students

in the voluntary-attendance class felt the class should have fewer class periods, but 18 percent of the students in the compulsory-attendance class felt there should be fewer class periods.

Item 3: More Practical Applications. Only a small percentage in each group -- 9 percent compulsory; 4 percent voluntary--suggested more practical applications.

Item 4: Required Class Attendance. Interestingly, not one of the compulsory-attendance group circled "required student attendance" but 24 percent of the voluntary-attendance group suggested this. This suggests the possible interpretation that at least some students wanted rules governing attendance.

Item 5: Wider Variety of Machines. Twenty-seven percent of the compulsory-attendance group and 16 percent of the voluntary-attendance group felt a wider variety of machines would improve the course.

Item 6: Voluntary Student Attendance. The response to this item was interesting in that no one in the compulsory-attendance class or the voluntary-attendance class suggested voluntary student attendance.

Item 7: More Advanced Business Machines. The compulsory-attendance class had higher achievement scores and fewer dropouts and only 9 percent suggested more advanced machines. At the same time, the voluntary-attendance class had lower achievement scores and more

dropouts; yet 20 percent of these students suggested more advanced machines. It could have been that the students in the voluntary-attendance class who circled this suggestion were the ones who persisted and had higher achievement scores.

Item 8: A Stronger Background in Mathematics. As stated previously there was a significant correlation between achievement and math ACT scores and it was not surprising that 20 percent of the voluntary-attendance group and 37 percent of the compulsory-attendance group suggested that a stronger background in mathematics would be helpful in succeeding in a Business Machines course.

The researcher attempted to find answers to several questions in this study. The following is an attempt to answer and discuss the questions raised in Chapter I.

Does compulsory class attendance improve academic achievement? This study provides evidence to suggest that students in individually-paced classes where manual dexterity is involved do achieve more when they are required to attend class. Adults attending a community college are usually involved in many other activities besides school that are very time consuming. Some of these activities include family and job responsibilities, church, social, and civic obligations. When attending class can be postponed without penalty, there is the possibility that it may be ignored or given a low priority.

If compulsory attendance does improve academic achievement, is such an improvement a result of poorer students dropping out? It was hoped that an answer to this question could be inferred through this study, but no clear conclusions seem possible. The compulsory-attendance class had average math ACT scores of 14.20, composite ACT scores of 14.43, and grade-point average of 2.572. The voluntary-attendance class had average math Act scores of 12.20, composite ACT scores of 12.40, and grade-point average of 2.123.. In observing individual scores, only two of the sixteen who dropped out had a grade-point average above 2.0; however, the ACT scores were varied with some as high as 28 and as low as 4. These low grade-point averages and high ACT scores could indicate alack of self-motivation on the part of those students.

Does compulsory attendance create poor attitudes among students? The students in the voluntary-attendance class had better attitudes, but the results of the questionnaire indicated that the compulsory-attendance class did not object to being required to attend class.

Do students at any age level achieve at a faster rate if they are required to attend class? The findings of this study cannot completely answer this question. However, the results do indicate that at least adults in individually-paced manual skills courses achievement at approximately the same rate when they attend voluntarily as when they are required to attend.

Can achievement be facilitated through a combination of self-teaching techniques and required class attendance? More evidence is needed by comparing different teaching methods with self-teaching techniques and voluntary and required class attendance before this question can be answered.

Recommendations for Further Research

Upon the basis of the findings of this study, the following recommendations for further research are suggested:

- (1) Since this study was limited to students enrolled in the two Business Machines classes at Seminole Junior College, it is recommended that a similar study be replicated with other Business Machines classes at Seminole Junior College and Business Machines classes at other community colleges to ascertain if the significant findings concerning achievement, attitudes, and completion rates can be repeated.
- (2) The findings of this study were based on the individually-paced method of teaching. It is suggested that a study be made similar to this one utilizing other teaching methods.
- (3) This study should be replicated with other populations; for example, with other classes at Seminole Junior College; other classes at other colleges and universities to see whether the findings are generalizable to those populations.
- (4) No attempt was made to ascertain the final attitudes of those students who dropped out. The possibility exists that the students

who dropped out had either the best or the poorest attitudes toward the course. Future research might include surveying the attitudes of the dropouts and their reasons for dropping out. Information from such a study would probably help instructors in their "holding power."

- (5) Future attention should be given to finding ways to enrich the educational experience so that students would look forward to attending class without being required to do so.

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APPENDIX A

EXAMPLES OF PROFICIENCY TESTS USED IN THE STUDY


OFFICE MACHINES — A Collegiate Course

Second Edition

Briggs and Kosy

ELECTRONIC PRINTING CALCULATOR
Achievement Test 4

Name _____

Date _____

Score: Test _____

Two achievement tests (Test 3 and Test 4) are provided on the Electronic Printing Calculator. Problems on fundamental machine processes as well as on application situations are provided in the tests.

An

DIRECTIONS

1. Round dollars and cents answers to the nearest cent.
2. Indicate *credit balances* as such. Credit balances not so labeled will be counted incorrect.
3. Record your answers in the Answers column.

Perform the calculations required.

1	2	3
\$ 427.03	6.1835	\$ 16.04
1,213.96	4.22	— 3.75
15.00	7.092	83.54
100.00	.0774	428.80
27.36	15.83	— 55.92
2,813.75	6.0076	3.81
86.77	.5575	— 16.58
10.09	1.375	4.59
638.82	.8062	10.80
86.57	37.5	4.99
103.49	4.49	— 38.88
27.37	2.3875	8.60

Provide for unrounded products.

- | | |
|--|--------------------------------|
| 4 $16.41 \times 3.975 =$ | 6 $16\frac{7}{8}\%$ of 28.7 = |
| | 7 $16\frac{7}{8}\%$ of 9.23 = |
| 5 $7\frac{1}{4} \times 207\frac{7}{8} =$ | 8 $16\frac{7}{8}\%$ of 203.9 = |
| | 9 $16\frac{7}{8}\%$ of .48 = |

Provide for quotients rounded at the 5th decimal.

- | | |
|------------------------|------------------------|
| 10 $86.1 \div 2.327 =$ | 12 $.2143 \div .056 =$ |
| 11 $23.04 \div .919 =$ | |

Percentage calculations.

- | | |
|----------------------------------|---|
| 13 \$83.60 is what % of \$1,350? | 15 $6\frac{3}{8}\%$ of \$2,600 is what? |
| 14 \$37.50 is 18% of what? | |

Provide for unrounded products.

- | | |
|--------------------------------------|--|
| 16 $(657 + 302) \times 8.8 =$ | 18 $(7.85 + 15.043) \times (5.3 - .187) =$ |
| 17 $(204.56 - 18.354) \times .195 =$ | |

- 1 _____
- 2 _____
- 3 _____
- 4 _____
- 5 _____
- 6 _____
- 7 _____
- 8 _____
- 9 _____
- 10 _____
- 11 _____
- 12 _____
- 13 _____
- 14 _____
- 15 _____
- 16 _____
- 17 _____
- 18 _____

$$19 \quad 2.04 \times 15.3 = 31.20 + 2.37 =$$

$$20 \quad 38.67 \div 3.14 = 16.7 - 3.45 = 7.7 =$$

Use 360-day basis.

$$21 \quad \$10,750 \div 5 \text{ } 1 \frac{1}{2}\% \text{ for 127 days} =$$

$$22 \quad \$673,800 \div 6 \text{ } 3 \frac{1}{2}\% \text{ for 93 days} =$$

Provide for quotients rounded at the 4th decimal.

$$23 \quad \frac{683}{27} + \frac{65.7}{3.821} + \frac{15}{33.6} =$$

$$24 \quad \frac{5.653}{8.04} - \frac{1.355}{.94} + \frac{123.9}{60.515} =$$

- 25 Calculate the cost of an article with a selling price of \$178.50 and a markup of $23 \frac{1}{2}\%$, mark-up based on selling price.
- 26 What is the selling price of a television set that cost the retailer \$259.60, with a markup of 38% based on selling price? Round selling price to the nearest dollar.
- 27 Calculate the percent that markup is of selling price on an article that cost \$315.60 and is priced to sell for \$439.90. Round the percentage figure at the fourth decimal.

Calculate the present value of the following noninterest-bearing notes.

Provide for answers rounded at the fourth decimal when calculating intermediate steps.

Maturity Value	Number of Months in Time Period	Discount Rate	Present Value
\$ 1,275	11 months	$6 \frac{3}{4}\%$	... 28
\$ 8,680	13 months	$7 \frac{1}{8}\%$	... 29
\$ 940	7 months	$8 \frac{1}{4}\%$	... 30

- 31 Kingsbury borrowed \$4,200 from Snyder on July 1, with principal plus interest at $5 \frac{3}{8}\%$ to be paid in one year. On September 1, Snyder discounted the note at the rate of $7 \frac{1}{2}\%$. What amount did Snyder receive as the present value of Kingsbury's note?
- 32 Sales of Holmes Corporation decreased 17.5% this year from the previous year. If this year's sales were \$755,205, what were the sales of the previous year?
- 33 Advertising expenses amounted to \$25,400 during the first six months of the present year. In the comparative period of last year, advertising expenses were \$11,600. What was the percentage increase in advertising expenses between these two periods?
- 34 Romano paid \$1,234 in income taxes this year, an increase of 82.5% over the amount he paid five years earlier. What was his income tax payment in this prior period?
- 35 Feinberg wrote \$1,225,000 worth of insurance last year and expects to increase this volume by 15% during the current year. If he does this, what will be his dollar volume of insurance this year?

APPENDIX B

TEXTBOOK ASSIGNMENT SHEET

BUSINESS MACHINES

Name _____

SS NO. _____

Semester _____

Adding Machine

Job 1 _____ (8) 17-24
 Job 1 _____ (8) 41-48
 Job 2 _____ (15) 24-31
 Job 2 _____ (10) 14-21
 Job 3 _____ (21) 2-24
 Job 3 _____ (28) 32-40
 Job 4 _____ (13) 2-13

Total _____ (113)

Monroe Disalaw Calculator

Job 19 _____ (4) 2-5
 Job 19 _____ (3) 33-42
 Job 20 _____ (4) 2-5
 Job 20 _____ (5) 16-20
 Job 20 _____ (19) 31-35
 Job 21 _____ (5) 31-35
 Job 21 _____ (10) 3-12
 Job 22 _____ (4) 62-65
 Job 22 _____ (4) 71-74
 Job 24 _____ (4) 2-5
 Job 24 _____ (4) 22-25
 Job 24 _____ (4) 2-5
 Job 25 _____ (4) 12-15
 Job 25 _____ (5) 323-350
 Job 25 _____ (7) 17-23
 Job 26 _____ (5) 25-29
 Job 26 _____ (5) 31-35
 Job 26 _____ (5) 63-71
 Job 27 _____ (6) 91-96

Total _____ (116)

Adler Princine Calculator

Job 10 _____ (5) 6-10
 Job 11 _____ (5) 6-10
 Job 11 _____ (9) 14-22c
 Job 11 _____ (14) 38-40
 Job 12 _____ (5) 11-15
 Job 12 _____ (5) 24-30
 Job 12 _____ (5) 34-40
 Job 12 _____ (8) 44-55
 Job 12 _____ (15) 13-20
 Job 13 _____ (5) 44-50
 Job 13 _____ (10) 67-76
 Job 14 _____ (10) 11-20
 Job 14 _____ (14) 22-35
 Job 14 _____ (14) 37-50
 Job 15 _____ (13) 22-35
 Job 15 _____ (9) 37-45
 Job 16 _____ (10) 2-11

Total _____ (156)

Monroe Princine Calculator

Job 26 _____ (5) 26-40
 Job 26 _____ (5) 44-50
 Job 29 _____ (5) 6-10
 Job 29 _____ (10) 23-30c
 Job 30 _____ (10) 2-11
 Job 30 _____ (10) 51-60
 Job 31 _____ (10) 2-11
 Job 31 _____ (10) 42-51
 Job 31 _____ (7) 64-70
 Job 32 _____ (7) 14-20
 Job 32 _____ (10) 21-40
 Job 32 _____ (2) 49-56
 Job 33 _____ (2) 52a-61b
 Job 34 _____ (4) 32a-34b
 Job 35 _____ (25) 21b-39
 Job 36 _____ (7) 11-17

Total _____ (141)

APPENDIX C

INSTRUMENT TO BE USED IN MEASURING
THE STUDENTS' ATTITUDES

STUDENTS' EVALUATION QUESTIONNAIRE

DO NOT SIGN YOUR NAME TO THIS QUESTIONNAIRE! ! !

Directions: Please help evaluate the Business Machines course and Instructor by completing this Questionnaire. Using the number codes provided, circle the number after each statement which most nearly reflects your opinion of the area being rated. Circle one, but only one, number on each continuum.

Number Codes

9 = Excellent
8 = Very Good
7 = Good
6 = Above Average
5 = Not quite up to Course
4 = Below Average
3 = Poor
2 = Very Poor
1 = Unacceptable

EVALUATION OF COURSE

1. Definition of course objectives	9	8	7	6	5	4	3	2	1
2. Class assignments and learning exercises	9	8	7	6	5	4	3	2	1
3. Presentation level of the course materials	9	8	7	6	5	4	3	2	1
4. Quality of the grading system used in the course	9	8	7	6	5	4	3	2	1
5. Overall organization of the course	9	8	7	6	5	4	3	2	1
6. Professional value of the course	9	8	7	6	5	4	3	2	1
7. Practical applications of the course content	9	8	7	6	5	4	3	2	1
8. Class attendance procedures	9	8	7	6	5	4	3	2	1
9. Overall opinion of the Business Machines class	9	8	7	6	5	4	3	2	1

EVALUATION OF INSTRUCTOR AND TEACHING PRACTICES

1. Knowledge of the subject matter	9	8	7	6	5	4	3	2	1
2. Ability to transmit knowledge to students	9	8	7	6	5	4	3	2	1
3. Quality of speech	9	8	7	6	5	4	3	2	1
4. Quality of personal mannerisms	9	8	7	6	5	4	3	2	1
5. Sense of Humor	9	8	7	6	5	4	3	2	1
6. Ability to arouse and maintain student interest	9	8	7	6	5	4	3	2	1
7. Ability to guide the learning process	9	8	7	6	5	4	3	2	1
8. Ability to tolerate others' opinions	9	8	7	6	5	4	3	2	1
9. Willingness to help students individually	9	8	7	6	5	4	3	2	1
10. Fairness to students	9	8	7	6	5	4	3	2	1
11. Overall opinion of the instructor	9	8	7	6	5	4	3	2	1

EVALUATION OF EQUIPMENT AND FACILITIES

1. Availability of machines	9	8	7	6	5	4	3	2	1
2. Age and performance of machines	9	8	7	6	5	4	3	2	1

Which of the following suggestions do you feel would help you get more out of the Business Machines class? (Circle the number of those which apply)

1. More class periods
2. Fewer class periods
3. More practical applications
4. Required student attendance
5. Wider variety of machines
6. Voluntary student attendance
7. More advanced business machines
8. A stronger background in Mathematics
9. Other (Specify) _____

APPENDIX D

INSTRUMENT USED TO MEASURE PARTICIPANTS'
LEVELS OF PREVIOUS EXPERIENCES
IN COURSEWORK AND
BUSINESS MACHINES

Name: _____ Date: _____

LEVEL OF PREVIOUS EXPERIENCE WITH BUSINESS MACHINES

1. Have you previously, taken a course in which one or more of the machines being used in the Business Machines classes was used as a teaching device? YES NO
 - 1a. If so, specify which machines were used?
 1. _____
 2. _____
2. Do you now or have you ever worked at a job where you had occasion to use any of the machines currently being used in the Business Machines classes? YES NO
 - 2a. If so, specify machines used and how often used.
 1. _____
 2. _____
3. Do you consider yourself to be proficient with any of the machines currently being used in the Business Machines classes? YES NO
 - 3a. If so, which machines are you proficient in using?
 1. _____
 2. _____
4. Which, if any, of the machines currently being used in the Business Machines classes do you own personally?
 - 4a. List.
 1. _____
 2. _____

PREVIOUS COURSEWORK EXPERIENCES

1. Have you taken any college-level accounting courses prior to enrolling in the Business Machines Course? YES NO
2. Have you taken any college-level Math courses prior to enrolling in the Business Machines Course? YES NO
3. Which course(s), if any, have you taken prior to enrolling in the Business Machines Course which have helped you understand the concepts and terminology used in the Learning Exercises and Problems?

Specify:

 1. _____
 2. _____
 3. _____
 4. _____