

AN ABSTRACT OF THE THESIS OF

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Title: THE EFFECT OF COMPUTER-ASSISTED INSTRUCTION VERSUS

TRADITIONAL INSTRUCTION ON ACHIEVEMENT IN PRINCIPLES OF

ACCOUNTING I AT THE JUNIOR/COMMUNITY COLLEGE LEVEL

Abstract approved:

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The purpose of this study was to determine if computer-assisted instruction was more effective than traditional instruction in the teaching of accounting principles classes at the junior/community college level. Sixty-three (N=63) junior/community college students enrolled in the Principles of Accounting I course at Colby Community College at Colby, Kansas, during the fall semester of the 1979-80 academic year acted as subjects in the study. Pretest-posttest achievement gain scores were used to test the null hypothesis concerning student achievement.

Summary

Using a two-way ANOVA, the results indicated that the two groups, the computer-assisted group (experimental) and the traditional group (control), were not significantly different in the existing variables at the time of the study.

A two-tailed t-score was used to test the null hypothesis concerning the two student groups' posttest scores. The results of testing this null hypothesis was that neither the experimental group nor the control group had significantly greater gains in achievement on the posttest.

Conclusions

There is no significant difference between the posttest scores of accounting students using the computer-assisted instruction method and the posttest scores of accounting students using the traditional instruction method.

Recommendations

1. A similar experiment should be conducted using a larger number of subjects to determine if the same results would be obtained. The results of such a study would increase the generalizability of the findings.

2. Additional research should be conducted matching students by ability levels. The difference in variances would be more accurate as they would not be attributable to something other than difference in ability.

3. A study should be conducted using the same basic design for the course known as Accounting II following Accounting I taught by the traditional method. It is possible that once students have learned the basic concepts, the computer could be used effectively to perform routine repetitive procedures.

4. Accounting instructors should continue to seek means of obtaining high achievement gains while reducing the amount of time needed to be spent on outside class assignments.

5. A similar study should be conducted in other areas of the accounting curricula.

6. A study measuring the effect of integrating the use of the computer in beginning accounting should be done to determine the effect on student interest and motivation.

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TRADITIONAL INSTRUCTION ON ACHIEVEMENT IN
PRINCIPLES OF ACCOUNTING I AT THE
JUNIOR/COMMUNITY COLLEGE LEVEL

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TABLE OF CONTENTS

Chapter	Page
1. INTRODUCTION	1
The Problem	2
Statement of the Problem	2
Null Hypothesis	2
Importance of the Study	3
Delimitations	4
Limitations	4
Definition of Terms	5
Methods of Procedure	6
Selection of Groups	6
Instrumentation	7
Instructional Materials	9
Instruction	10
Statistical Treatment of Data	11
2. REVIEW OF RELATED LITERATURE	14
Development of the Computer	15
Computers in Education	18
Computer-Assisted Instruction in Accounting	21
Related Studies	24
Summary	28

Chapter	Page
3. RESULTS OF STATISTICAL ANALYSIS	30
Descriptive Statistics of the Groups	30
Comparisons of Sample Variances	31
Results of Testing the Null Hypothesis	34
Summary of Results	36
4. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	37
Summary	38
Conclusions	38
Recommendations	39
BIBLIOGRAPHY	40
APPENDIXES	46
APPENDIX A - ASSIGNMENT LIST	47
APPENDIX B - REVIEW PROCEDURE AND SAMPLE PRINTOUTS	49
APPENDIX C - RAW SCORES	56
APPENDIX D - TWO-WAY ANOVA STATISTICAL TEST	58
APPENDIX E - TWO-TAILED <u>t</u> -TEST STATISTICAL TEST	60

Chapter 1

INTRODUCTION

Computers affect our daily lives in a variety of ways. Each day, each one of us has some dealing with a computer. Computer technology has grown so fast since the initial introduction of the uses and the possibilities of computers in 1959 that the impact on the life-styles of people has not been equaled.

The computer in education is the first essential step toward the understanding of the computer and its impact on society. The real argument for more educational computing goes beyond merely using the computer as an efficient means of instruction. Computer-assisted instruction is one of the more meaningful, direct links that today's students have with the outside world.¹

The computer is also changing the accounting profession both in business and in education. Both the accountant in the field and the student in the classroom are having to do less routine manual bookkeeping through the use of computers, which permits more analysis and interpretation of financial records and procedures. In the 1960's, it was predicted that this would happen; in the 1970's, it had

¹Harold J. Peters, "The Electronic Aristotle," Computer Decisions, July, 1976, p. 46.

become a reality.¹ These changes that are taking place have far-reaching implications in the teaching of accounting.

The Problem

Past emphasis in accounting classes has been on recording details. Students were taught how to keep a set of books, but the computer is changing the concept of what constitutes a set of records. The importance of manual recording in accounting has decreased. The content of accounting must be updated so that accounting students can aid business in an area of concern--the efficient management and processing of data. Today, this is being accomplished through the use of the computer in everyday business transactions.

Statement of the Problem

The purpose of this study was to determine if computer-assisted instruction was more effective than traditional instruction in the teaching of accounting principles classes at the junior/community college level.

Null Hypothesis

There is no significant difference between the posttest scores of accounting students using the computer-assisted instruction method and the posttest scores of accounting students using the traditional instruction method.

¹Paul A. Tambrino, "Computers and the Accounting Program," Business Education World, LIX (May-June, 1979), 27.

Importance of the Study

As computer-assisted instruction increases in importance, it becomes equally important that teachers understand the various roles that they and computers will play.¹ With such an understanding, teachers should be able to motivate their students and to key the instruction to the backgrounds and interests of the classes.

As students and the teachers observe the usefulness (and the limitations!) of computers in instructional and in other school activities, they will learn much about the role of computers and computer technology in society.²

Brashear observed that:

One of the broadest aspects of education is to prepare a person to live in his own society. When the patterns of society change as quickly as they do now, obsolescence plagues us--obsolescence of faculty as well as of subject matter.³

Kaluza concurred in stating that "the emphasis must be shifted from the mastery of manual techniques alone to the mastery of concepts that apply to all techniques."⁴ The major technique to be discussed in this study is that of data processing concepts as related to accounting.

¹B. L. Hicks and S. Hunka, The Teacher and the Computer (Philadelphia: W. B. Saunders Company, 1972), preface.

²Ibid., p. 22.

³Myrl Chastine Brashear, "The Impact of Data Processing on Business Education," Business Education Forum, XXV (October, 1970), 63.

⁴Henry Kaluza, "Teaching Accounting Concepts in Introductory Accounting Courses," Business Education World, LII (March-April, 1972), 14.

The fundamentals of electronic data processing will have to be integrated into the instruction of accounting throughout the entire course in the future.

Delimitations

This study was delimited to the following two methods of instruction: computer-assisted instruction and traditional instruction. Further delimitations included the use of sections B and D of Principles of Accounting I during the 1979 fall semester at Colby Community College, Colby, Kansas. The computer system used was the Digital Basic Computer with keyboard, screen, floppy disks, and printer.

Limitations

The student population was limited to the two sections of Principles of Accounting I taught by the researcher at Colby Community College, Colby, Kansas, during the 1979 fall semester. The majority of the students were classified as freshmen.

The information regarding students' bookkeeping/accounting background was limited to the response given by the student at the time of enrollment. While this information in most cases was accurate, some students did not receive proper placement because of the response given.

The information regarding students' achievement was limited to their responses to the number and type of problems contained on the Russell-Sanders posttest. While this test is considered to be a valid and reliable instrument, the students probably learned more material than that covered by the test questions.

The assignments given to the students in both the computer-assisted group and the traditional group were limited to those contained in Accounting Principles (twelfth edition); Niswonger and Fess, published by the South-Western Publishing Company.

Definition of Terms

The following definitions should help the reader to better understand this study.

Computer-Assisted Instruction

Computer-assisted instruction (CAI) is a pedagogical technique in which a student interacts with instructional stimuli at a computer terminal, usually on a one-to-one basis.¹

Traditional Instruction

Traditional instruction is taught in the "lecture-do" method, and is structured to lead all students in a class through the course at a uniform learning rate.²

Accounting

Accounting is the art of recording, classifying and summarizing in a significant manner and in terms of money,

¹David B. Thomas, "The Effectiveness of Computer-Assisted Instruction in Secondary Schools," AEDS (Association for Educational Data Systems), XII (Spring, 1979), 103.

²J Marshall Hanna, "Meeting Individual Needs in High School Accounting," Business Education World, LV (November-December, 1974), 21.

transactions and events which are, in part at least, of a financial character, and interpreting the results thereof.¹

Junior/Community College

Junior/community college refers to a two-year college with college credit that is transferrable to a four-year institution.

Methods of Procedure

For this study, sixty-three (N=63) junior/community college students enrolled in the Principles of Accounting I course at Colby Community College at Colby, Kansas, during the fall semester of the 1979-80 academic year acted as subjects in the research which compared the effects of two different methods of teaching the basic concepts of the course. One group, the experimental group (N=35) was taught by a computer-assisted method. The second group, the control group (N=28), was taught by the traditional method. Pretest-posttest achievement gain scores were used to test the null hypothesis concerning student achievement.

The methods and procedures used in conducting the study follow in these sections.

Selection of Groups

Before this study could take place, permission was requested and received from Dr. James H. Tangeman, President,

¹Eric L. Kohler, A Dictionary for Accountants (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1965), p. 5.

Colby Community College, Colby, Kansas. This gave the researcher permission to use sections B and D of Principles of Accounting I during the 1979-80 fall semester for the experimental and control groups for the study.

Upon enrollment, students were asked whether they had had any previous bookkeeping/accounting instruction and/or experience. If the response was "no," the student was placed in section B or D. If the students had responded "yes," additional questions concerning this background were asked to further aid in placement. If the background was sufficient for the basic theory, students were placed in sections A or C.

Instrumentation

The research design used for this study was a comparative experiment. This research design served two purposes: (1) it provided answers to research questions posed by the researcher, and (2) it controlled external sources (independent variables) of variation. A paradigm of this research design as first used by Johnson is presented in Figure 1.¹

It was necessary to determine the academic achievement of students both before and after the experiment was conducted. Several tests were reviewed and considered. The one chosen for use as the pretest and the posttest for both groups was the Russell-Sanders Bookkeeping Test, Test I-B, which is composed of the following subtests: (1) Classification of

¹Carlos Edward Johnson, "The Effects of Computer Assisted Instruction on the Academic Achievement of Students Enrolled in Accounting I Classes" (EdD dissertation, Oklahoma State University, 1977), p. 30.

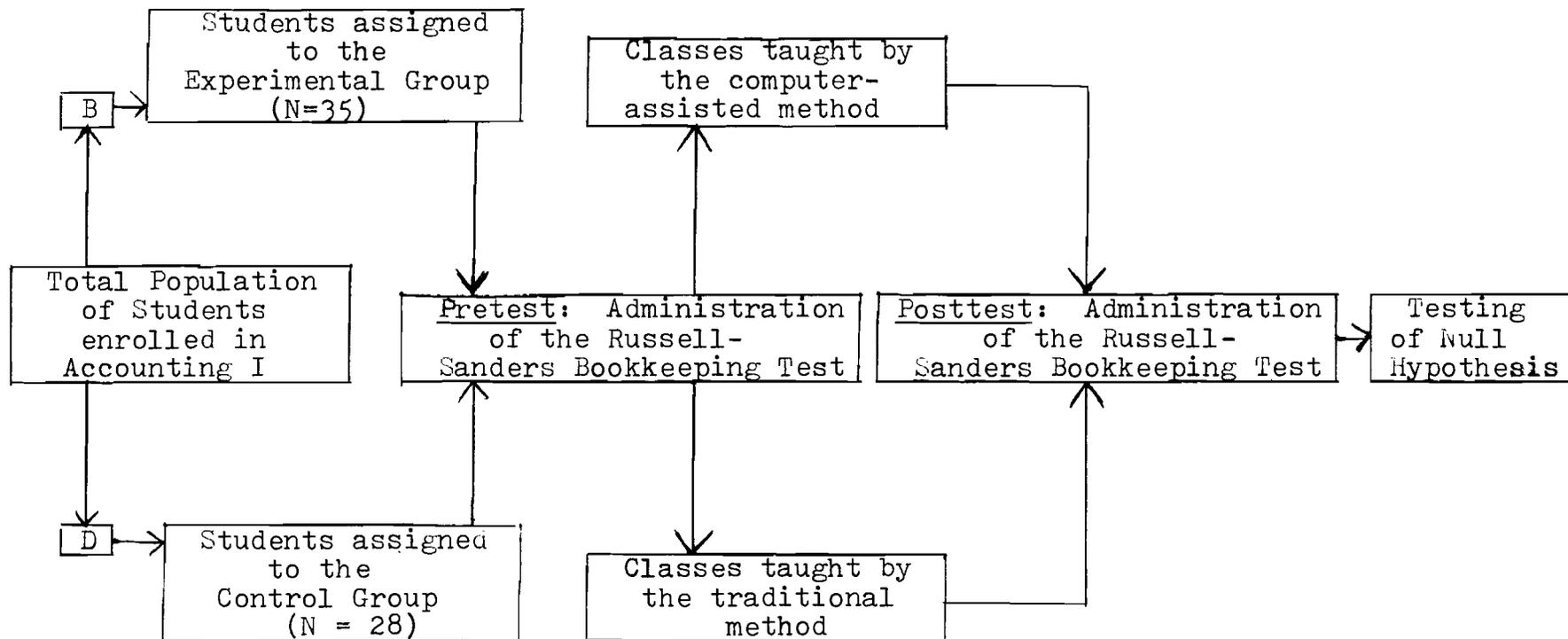


Figure 1. Research Design Used in the Study.

Accounts (20 items), (2) Basic Accounting Concepts (16 items), (3) Recording Transactions (20 items), and (4) Adjusting and Closing Entries (20 items), and (5) Cost of Merchandise Sold Section (14 items).¹ The instrument was a controlled item and could not be reproduced as appendix material.

The items of the test were selected on the basis of the common content of several leading textbooks and courses of study. The reliability of the test was determined by the split-half method. The validity of Russell-Sanders Bookkeeping Test, Test I-B, is reported as .90. This validity is sufficient for the present study.

Instructional Materials

Both the control group and the experimental group used the same textbook, Accounting Principles, twelfth edition, by Niswonger and Fess;² working papers, Accounting Principles Working Papers, twelfth edition;³ and laboratory materials, Audio Cassette Study Guides 1 and 2 and Tapes.⁴

¹Raymond B. Russell and M. W. Sanders, "Russell-Sanders Bookkeeping Test; Test 1, Form B" (Emporia, KS: Bureau of Educational Measurements, 1964).

²C. Rollin Niswonger and Phillip E. Fess, Accounting Principles. (12th ed.; Cincinnati, OH: South-Western Publishing Co., 1977).

³Ibid.

⁴Wilbur F. Pillsbury, Audio-Cassette Study Guides and Tapes (Cincinnati, OH: South-Western Publishing Co., 1976).

In addition to the textbook, the experimental group used materials from Computer-Augmented Accounting (CompuGuide One), third edition, by Pillsbury.¹

Students in the computer-assisted class utilized the computer in completing homework assignments and learning exercises. Students in the traditional accounting class were not allowed to use the computer in completing homework assignments and learning exercises.

Instruction

The class instruction for both the control and experimental group consisted of the usual oral presentation and group discussion of the textbook materials. The only teaching aids were the textbook, the working papers, teacher-made handouts, and an audio laboratory with manuals. The experimental group, in addition to these teaching aids, used the Digital Basic Computer for homework problems.

The control group and the experimental group were taught by the same teacher. Both groups covered the same textbook material and at approximately the same rate. The control group and the experimental group were assigned the same drills, problems, and homework. The complete list of all assignments can be found in Appendix A. The same chapter and unit tests were administered to both groups.

¹Wilbur F. Pillsbury, Computer Augmented Accounting, CompuGuide One (3rd ed.; Cincinnati, OH: South-Western Publishing Co., 1979).

The study covered sixteen weeks of the school year and chapters one through eleven in the textbook and working papers.

Students in the computer-assisted class were asked to bring their computer printouts to class and discuss results or procedures they did not understand. In addition to doing the assigned homework on the computer, the experimental group also used the computer for review of each chapter in the form of direct interaction with the computer and immediate feedback of progress. A sample of this review procedure and an example problem printout is presented in Appendix B.

Statistical Treatment of Data

The statistical procedures used in testing the null hypothesis were the analysis of variance and a two-tailed t-test. These procedures were necessitated by the presence of unknown variables of the subjects involved in the experiment.

The analysis of variance (ANOVA) is used to determine whether the mean scores on one or more factors differ significantly with each other. The analysis of variance is also used to determine whether sample variances differ significantly from each other.¹ The analysis of variance permits statistical rather than experimental control of variables.

The following benefits were obtained from the use of the analysis of variance procedures: (1) any variable that

¹Sanders, Donald H., A. Franklin Murph, and Robert J. England. Statistics: A Fresh Approach (New York: McGraw-Hill Book Co., 1980), p. 428.

influenced the variation of the criterion (dependent) variables may be controlled, and (2) the error variance in the analysis was substantially reduced.¹

All statistical techniques involve assumptions which must be met if the techniques are to be validly applied to a decision-making situation. In the case of analysis of variance, the following assumptions must be made: (1) the samples are drawn randomly, and each sample is independent of the other samples; (2) the populations under study have distributions which approximate the normal curve; and (3) the populations from which the sample values are obtained all have the same population variance (σ^2).²

The two-tailed t-test for two independent sample groups (control group versus experimental group) was used to determine whether the means between the two groups differed significantly at the .05 level of significance. This test was also used because of having no preconceived notion as to the direction of the outcome made with respect to the null hypothesis. With a null hypothesis, the results can be significantly different with one method or the other showing greater achievement, or the results can be of no significant difference between the achievement of the two methods. The two-tailed t-test allows for any one of the three outcomes (retain H_0 , H_1 , or H_2).

¹John T. Roscoe, Fundamental Research Statistics for the Behavioral Sciences (New York: Holt, Rinehart and Winston, Inc., 1969), p. 255.

²Sanders, loc. cit.

H_0 is the null hypothesis that there is no significant difference between the posttest scores of the computer-assisted instruction method and the traditional instruction method.

H_1 is that the computer-assisted posttest scores were significantly higher than the posttest scores of the traditional method students. H_2 is that the traditional method posttest scores were significantly higher than the posttest scores of the computer-assisted method students.

This test for a significant difference was made at the .05 level. The level of significance cannot be used to predict the results of future studies (which all conditions of the original study are replicated); it can only be used to make a decision about rejecting or accepting the null hypothesis. The .05 level of significance was selected by the researcher to be the minimum acceptable probability of occurrence which is also the risk of erroneously rejecting the null hypothesis when the null hypothesis is in fact true.¹ The researcher decided the .05 level of risk was sufficient for this study of mean differences.

¹Ibid., p. 177.

Chapter 2

REVIEW OF RELATED LITERATURE

Accounting is one of the most popular courses in the high school, second only to typewriting in terms of enrollment. Yet there is some indications that unless the course is re-shaped, it will lose this popularity because it will no longer provide up-to-data knowledge.

I predict by 2000 AD that the bookkeeping as it exists today in our schools will become a "thing of the past." There are some "pessimists" who believe that it will not take that long. They assert that, because of the electronic computer, the course is obsolete now and is on a steady "uphill climb to the bottom."¹

Computers are giving accountants opportunities to increase their effectiveness. By using computers, accountants are capable of performing their jobs more smoothly, easily, and rapidly.² Computers affect our daily lives with the use of computerized billings, the processing of bank data, and grocery checkout lanes, etc. The list is endless. Many dealings we have with computers are taken for granted and go unnoticed.

¹Marian P. Walker, "Prediction for 2000 AD--Bookkeeping Will Be Dropped From the High School Curriculum," Journal of Business Education, XLIV (February, 1969), 199.

²Tambrino, loc. cit.

The need for the integration of the computer into our educational system has been an area of concern for many years. Students and teachers, like other citizens, will live in a society that will be influenced more and more by the computer and its technology.¹ The National School Public Relations Association made the following observation in 1968:

The digital computer was first put on the commercial market in 1950. Now, just 27 years later, leaders in government, business, and education are warning that any student who does not receive some background in computer technology during his school career is getting a second-class education.²

Accounting teachers face the challenge of fundamental changes in approaches, methodology, and material to other technological developments in our society and to the students who need to be prepared for employment in this technological society.

Development of the Computer

The populations of the world have used "computers" in one form or another since as far back as 3000 BC when the abacus first was used. Even today, the abacus is the most widely used calculator in Asia and is used by over half of the earth's population.

The middle of the seventeenth century brought the first calculating machine invented by Blaise Pascal. This machine would perform addition, subtraction, and multiplication. The

¹Hicks, loc. cit.

²Computers: New ERA For Education (Washington, DC: National School Public Relations Association), 1968.

major problem with this calculator as well as the ones to come during the next several hundred years was "the difficulty of making parts for the machines with sufficient accuracy for reliable performance."¹

The first punched-card machine was invented by Joseph Marie Jacquard in the early 1800's. The punched-card was to control the action of a weaving loom in order to weave intricate designs in cloth. Many of the punched-card machines built in the mid-1800's are still in use today.

In Cambridge, England, a man named Charles P. Babbage contributed the first major step in the development of computers. That step was to use Jacquard's cards "to store not only the variables to be operated on, but the quantities arising from the results of other operations. The concept called for separating the data from the instructions."² This was the forerunner of the program concept.

Punched-card accounting machinery (PCAM), also called electronic accounting machinery (EAM) as developed by Jacquard, Herman Hollerith (Hollerith Code), and James Powers (present punch card layout), is the forerunner of our modern-day electronic data processing equipment.

Other developments include the Mark I Relay Calculator; the ENIAC (Electronic Numerical Integrator and Calculator), which was the first to use vacuum tubes and electronic circuits;

¹Richard A. Bassler, "The Computer Industry: Yesterday," The Journal of Data Education, XV (October, 1974), 13.

²Ibid., p. 14.

the ENIAC (Electronic Numerical Integrator and Calculator), which was the first practical automatic digital electronic computer; and EDSAC (Electronic Delay Storage Automatic Calculator) and EDVAC (Electronic Discrete Variable Automatic Computer) which used the binary number system.

The first commercially available computer was the UNIVAC (Universal Automatic Computer) in 1951. UNIVAC was one of the first computers to use magnetic tape for input and output operations.¹

An onslaught of new computers occurred during the years 1951-1954. A new computer appeared to be announced almost daily. During the 1960's, everyone jumped on the bandwagon and bought computers. These people had little or no computer background which was needed with the early computers. These computers were also quite costly. In the 1970's, data processing was concerned with cutting budgets, and solid operating practices of computer operation became a priority to users and makers alike.

When talking about the computer industry, people talk in terms of twenty-five years. But the advent of the technologies of computers can be seen to go back almost as far as man himself.

¹Ibid.

Computers in Education

Bernard Shaw once said, "The reasonable man adapts himself to the world; the unreasonable man attempts to adapt the world to himself. Therefore, all progress depends on the unreasonable man."¹

Science and technology, like the unreasonable man, frequently, and often violently, move to change the world. Society is undergoing rapid change as the result of computer technology. To expose students to the environment in which they will be living, teachers must include in their education the cultural and technological aspects of computers.²

There exists today many computer-assisted instruction systems which, controlled by suitable computer programs, can be used for an astonishing variety of educational activities. Johnson stated that the five-year olds who enter kindergarten will have their registration papers processed by a computer. When these students graduate years later, the diploma or degree received will have been prepared by a computer. In between, the computer will assist in teaching, counseling, scheduling into classes, testing, grading papers, helping with homework, and providing report cards. As students struggle through reading and arithmetic, the computer will be the tutor.

¹Ralph W. Gerard, "Shaping the Mind: Computers in Education," Computer-Assisted Instruction: A Book of Readings, ed. Richard C. Atkinson and H. A. Wilson (New York: Academic Press, 1969), p. 15.

²Harry F. Silverman, "Applications of Computers in Education," Computer-Assisted Instruction: A Book of Readings, ed. Richard C. Atkinson and H. A. Wilson (New York: Academic Press, 1969), p. 49.

If information is needed, students can consult their library. In addition to this source of information, students may also retrieve materials instantaneously from other libraries in the United States, and eventually in the world. With the help of the computer, students will be able to solve complex problems that were formerly assigned to only more advanced students. When deciding on a vocation or college, the computer will help by exploring the different alternatives and suggest the training that will be needed. The versatile computer can provide teachers and administrators with the printed records of students' progress so the administrators can determine where to make curricula revisions.¹

Not only will computers revolutionize the educational process, but the learning environment as well. The following assumptions have been made concerning computer-assisted instruction:

1. Computer-assisted instruction will surely come into general use in the schools, probably within the next decade, and probably before either the schools or manufacturers of CAI systems can ensure its wise use.
2. Any lesson in any subject can be programmed for CAI after the lesson strategy can be explicitly defined and the lesson materials represented in words, pictures, and experiments to be presented to the student by the CAI system.
3. Computer-assisted instruction is capable of becoming a widely used, versatile, and effective educational tool, but must overcome many handicaps impeding its development.

¹Johnson, op. cit., pp. 9-10.

4. Teachers are a basic educational resource. Society has given them the primary responsibility in educating the next generation.

5. Both the individual satisfaction of the teacher and his effectiveness as an educator will be enhanced when the teacher understands and helps to manage revolutionary new tools like CAI when they are introduced into the schools.

6. The elements of instructional strategy and of instructional programming are similar for the classroom and for CAI, and can be made accessible to the education student and to the teacher.

7. Students can and should aid in the development of CAI. They should not be used solely as guinea pigs.¹

The capabilities of computer-assisted instruction are something to be considered, studied, and understood by all teachers, present and future.

1. CAI can liberate: its patience, accuracy, and perfect memory are ideally suited to the part of remedial instruction that depends upon these capabilities. Human teachers have only finite patience, accuracy, and memory.

2. CAI is powerful: unlike the teacher, it can do computations accurately and rapidly, both of arithmetic and of logical nature. It can produce elaborate graphs and drawings and perform sophisticated retrieval of information from large data banks.

3. CAI is very flexible: it can perform in any style or logic of teaching that can be defined by the lesson-writer or curriculum deviser. The "languages" for constructing a great variety of teaching strategies become easier to use year by year.

4. CAI is compatible with live teaching: it can be used side-by-side or alternatively with person-to-person or "live" teaching. More generally we should visualize a cooperative educational endeavor, however structured, involving the teacher, the student, and the computer.

¹Hicks, op. cit., pp. 21-25.

5. CAI can evaluate: the retrieval and computational powers of the machine can be used by the teacher to get immediate evaluation of student performance. This instant evaluation has not been available, without CAI even in the most well-staffed curriculum projects.¹

Computer-Assisted Instruction in Accounting

Using the computer as a means of teaching accounting is relatively new. But with the ever-expanding technology, the demands of society and business, and increasing aid from the federal government, the slow start that the use of computers in education has had will catch up with the demands. Within the past fifteen years, the usage of computers in education has progressed to the point where today nearly every university and more than one-third of the four-year colleges provide computer services for research and instructional purposes.²

Students need to do more than just memorize accounting terms and procedures. To meet the needs of the student, teachers must have a broader lease than just the textbook for introducing realism into the classroom. The use of the computer can do just that. In 1967, Younghusband surveyed the opinions of bookkeeping/accounting teachers in Northern Illinois and from the response to the questionnaire it was concluded that:

¹Ibid., p. 25.

²Paul G. Watson, Using the Computer in Education (Englewood Cliffs, NJ: Educational Technology Publications, 1972), p. 4.

Due to the advent of automated data processing it is considered essential to either (1) include some general information about electronic data processing in various appropriate parts of the course, or (2) teach a separate unit on electronic data processing as it relates to accounting procedures.¹

For a number of years, the computer has been used as a tool in accounting. Today the trend is toward integrating data processing with a number of business courses with special emphasis being in the bookkeeping/accounting course.

One way to introduce accounting students to computers is to set up a simulation where almost all of the procedural aspects of accounting (journalizing, posting, balancing accounts, preparing a trial balance, preparing a worksheet, and preparing an income statement and a balance sheet) are computerized. Students may then devote more time to such essential concepts as: (1) analyzing and interpreting data in financial statements; (2) locating errors and correcting them; (3) classifying source documents according to the system established; and (4) understanding the business enterprise such as its results of operation.²

The emphasis of teaching accounting is shifting away from the manual computations toward the analysis and interpretations of financial records, the accounting theory and managerial applications behind the operations, and the resulting benefits of these changes to the consumer. Today's accounting student will be dealing with more than just the manual recording of transactions.

¹William Younghusband, "A Survey of Current Opinions and Practices of Bookkeeping Teachers in Northern Illinois Public Secondary Schools (Excluding Schools in Cook County) Regarding the Major Issues in Bookkeeping Instruction" (Master's thesis, Northern Illinois University, 1967), National Business Education Quarterly, XXXVIII (October, 1968), 56-57.

²Tambrino, loc. cit.

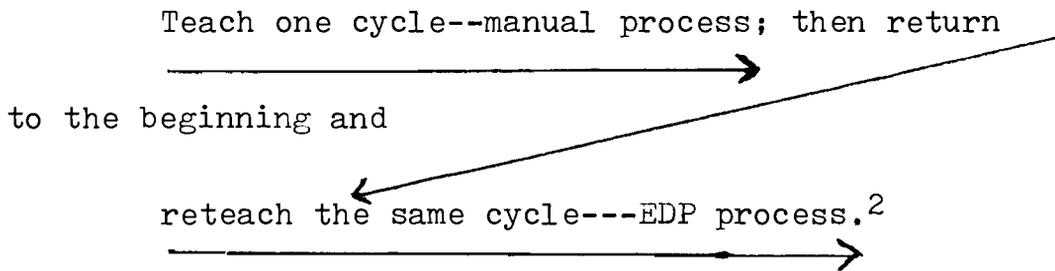
Two other approaches of integrating the use of the computer into accounting are the unit approach and the integrated approach. The unit approach is that the use of the computer should be taught as a survey unit in accounting. Some areas of the unit are the history, social implications, job opportunities, and the importance of the computer.

The integrating approach can be further broken down into the horizontal-staging and the vertical-staging.

Horizontal staging is described as:

Teaching the entire accounting cycle via the manual process as the first step. Then, reinforcement for the cycle is provided with an analytical exercise of the financial statement. Following the analytical exercise, the teacher will reteach the same cycle again; but now he relates the accounting concepts to the EDP system.¹

This approach would be diagrammed as follows:



The vertical-staging approach is described as:

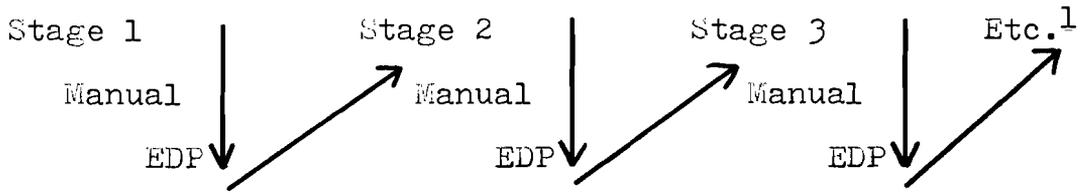
Teaching one step or concept of the manual system immediately followed by a teaching of the same step relating the theory to the EDP system. When appropriate practice and comprehension at "stage one" for both manual and EDP systems have been achieved, teaching then is undertaken at "stage two"--manual accounting followed by the EDP accounting procedures. This procedure is continued until the entire accounting cycle has been taught.³

¹Donald A. Nellerroe, "An Integration Approach: EDP into Manual School Accounting," Journal of Business Education, XLVIII (October, 1972), 21-23.

²Ibid.

³Ibid.

The diagram for this approach would appear as:



Related Studies

Studies have been done to test the theory of computer-assisted instruction in Accounting. Most studies are recent because of the newness of the idea.

Baxter found that there was no significant difference in achievement scores between the total control group and the total experimental group at Georgia State Southwestern College, Americus, Georgia, during the fall quarter of 1973. The two groups compared were degreed and non-degreed students. The conventional method and the computer-augmented instruction were the two methods compared. Baxter was also interested in any time difference with relationship to homework assignments. It was found that the computer-augmented students required significantly less time than did the conventional students. From his findings, Baxter made the recommendations that the computer augmented method should be considered an appropriate method of teaching first-quarter collegiate Principles of Accounting and that a similar study should be conducted in other areas of the collegiate accounting curricula.²

¹Ibid.

²Clifton Arthur Baxter, "The Effects of Computer-Augmented Instruction on Achievement in the Collegiate Principles of Accounting Course" (EdD dissertation, University of Georgia, 1974), abstract.

In 1974, Saul conducted a study comparing two methods of instruction in beginning accounting courses. Saul also compared attrition as well as achievement. The two methods used were the conventional method and computer-augmented instruction. All beginning accounting classes during one semester at Miami-Dade Junior College during the Winter semester of 1972 were used in the experiment. Three of the classes used Accounting by Computers (ABC) materials; Computer Augmented Accounting instructional materials by Pillsbury were used in nine of the classes; and the other nine classes were instructed by the conventional method. His findings were "neither experimental group was significantly different from the conventional group."¹ Saul also found that the materials used for instruction made no difference in attrition.

One result should be noted at this point. Even though Saul found neither experimental method was significantly different from the conventional group, it was found that the ABC material was significantly superior to the Pillsbury material on the basis of the two covariates--the Otis test and the teacher-prepared pretest.

Several recommendations were made by Saul. The use of Pillsbury material should be discontinued until a more effective use in accounting is developed, and ABC materials

¹William Eugene Saul, "An Experimental Study of the Effect of Computer Augmented Instruction on Achievement and Attrition in Beginning Accounting at Miami-Dade Community College, North Campus" (EdD dissertation, University of Tennessee, 1974), abstract.

should continue being used in accounting. Saul suggested that an additional study be made comparing the ABC instruction and the conventional method and that a study measuring the effect of integrating the use of the computer in beginning accounting should be done to determine the effect on student interest and motivation.

In 1976, Arnett of the University of California, Los Angeles, compared computer-assisted instruction and the conventional method at California State College. The findings were that there was "no significant difference in achievement between the computer-assisted instruction group and the control group, as measured by the criterion test. Another finding was the students in the experimental group were found to have been highly motivated.¹ Students seemed excited at the prospect of being able to use the computer and gain meaningful data from it. Most students expressed great interest in taking other accounting classes in which some type of computer-assisted instruction would be used.

A study done at Arizona State University in 1971 by Werner compared two methods of teaching data processing and accounting concepts in high school accounting. One method taught data processing concepts as a separate unit (unit approach), and the other was the integrated approach where

¹Stephen Jay Arnett, "Comparison of Computer Assisted Instruction Versus Conventional Instruction in a Beginning Accounting Course" (PhD dissertation, University of California Los Angeles, 1976), abstract.

students received data processing concepts and accounting concepts at the same time interrelated throughout the course.

Werner concluded that students learn accounting concepts equally well regardless of the approach used for data processing concepts. On the other hand, students can achieve at a significantly higher rate in business data processing when those concepts are an integrated part of the accounting instruction.¹ Werner, therefore, recommended that business data processing should be integrated with accounting instruction.

The only study located by this researcher that found different conclusions than the studies already cited was the Johnson study, 1977, in which Johnson compared the effects of computer-assisted instruction on the achievement of students enrolled in Accounting I classes at the college level versus achievement using the traditional method of instruction. This study was conducted at Oklahoma State University, Stillwater, Oklahoma. Johnson found that there was a significant difference in achievement between the computer-assisted experimental group and the conventional control group. Results led to the conclusion that "students taught by the traditional method appeared to learn more . . . than students taught by the computer-assisted method."² On the other hand, Johnson

¹Donald Allan Werner, "A Comparison of Two Methods of Teaching Business Data Processing and Accounting Concepts in High School Accounting" (EdD dissertation, Arizona State University, 1971), abstract.

²Johnson, op. cit., p. 57.

found that the students taught by the traditional method saw very little educational value in the routine and repetitive calculations even though they achieved more than students taught by the CAI method. Johnson did find what Arnett found in relation to the motivation of the students: computer-assisted students were more highly motivated than the traditional students.

Upon those findings, Johnson made this conclusion:

". . . the computer would be a more useful tool in teaching college level accounting courses if it were used in conducting supplementary training sessions after participants had mastered the concepts and practices taught in Accounting Classes.¹

Summary

The automation of data presents almost unlimited possibilities both in changing the accountant's job and in providing additional data to management. While the mechanics of the accounting system--the basic debits and credits--remain the same, the job takes on the added dimension of concern for computers input and output. Never before has the world seen technology develop and affect business and society at such a rapid rate.

The review of the literature provided a solid base for this study. With computers playing a greater role in the lives of all people, students need to be introduced to the realism of computers.

¹Ibid., p. 58.

Many studies have been done on how the computer has been integrated into various instructional systems and courses. The majority of studies concluded that there is no significant difference in the learning to take place using the traditional approach as compared to the computer-assisted approach to teaching.

Chapter 3

RESULTS OF STATISTICAL ANALYSIS

Sixty-three (N=63) junior/community college students enrolled in Sections B and D of Principles of Accounting I classes acted as subjects in an experiment which compared the achievement gains of students who were taught by two different methods. Students were enrolled at Colby Community College in Colby, Kansas, during the fall semester of the 1979-80 academic year. One group, the Experimental group (N=35), utilized the college's math and science data processing facility to assist their learning activities in the Accounting I class. The other group, the Control group (N=28), was taught by the traditional method, and was not allowed to use the computer in completing course assignments and learning exercises. The Russell-Sanders Bookkeeping Test, Text I-B, was administered to both groups on a pretest-posttest basis as a means of determining achievement gain. Pretest-posttest achievement change scores were utilized in testing the null hypothesis. This chapter contains the results of the statistical calculations made in the study. The raw scores of both groups are presented in Appendix C.

Descriptive Statistics of the Groups

The first step in the data analysis procedures was to compute the descriptive statistics for the student groups.

The means (\bar{X}) and standard deviations (S) for each group are presented in Table 1.

The computer-assisted group (experimental) showed a mean of 58.57. The traditional group (control) showed a mean of 54.5. This is a difference of 4.07 or 4.5% (4.07 ÷ 90 points possible). A survey of the mean values computed for the two groups shows that students taught by the computer-assisted method made significantly greater gains than students taught by the traditional method.

The standard deviation of the experimental group was 3.79. The standard deviation of the control group was 3.39; a difference of .40.

Comparisons of Sample Variances

It was also necessary to compare the variances of the posttest scores of the two groups of students. These comparisons were necessary in order to determine whether the variances were statistically equal--a primary assumption of the two-way analysis of variance testing statistic. Comparisons were made by using a two-way ANOVA.

The group variances and results of the statistical calculations are presented in Table 2. These results show that the sample variance being compared with the two-way ANOVA were not significantly different. This allowed the researcher to continue with the analysis.

The formula and data used in computing the variances are presented in Appendix D. For the experimental group, a

Table 1
Means and Standard Deviations
Computed for the Groups'
Posttest Scores

Computer-Assisted Teaching Method	Traditional Teaching Method	Totals
X = 58.57	X = 54.50	X = 56.76
S = 3.79	S = 3.39	S = 3.54

Table 2
 A Comparison of the Variances
 Computed for Groups'
 Posttest Scores

Source of Largest Variance	Source of Smallest Variance	Critical Value	F-Ratio
Computer-Assisted Class ($s^2 = 502.28$)	Traditional Class ($s^2 = 322$)	F = 1.88	F = 1.33*

*Not Significant at the .05 level

mean of 58.57 was used with 34 used as degrees of freedom. For the control group, 54.5 was used as the mean and degrees of freedom of 27. At the .05 level of significance, an F-score of less than or equal to 1.88 would indicate that the variances were homogeneous. Following the computations, the F-score was computed to be 1.33. The variances were considered homogeneous.

Results of Testing The Null Hypothesis

The null form of the hypothesis was as follows:

H₀ There is no significant difference between the posttest scores of accounting students using the computer-assisted instruction method and the posttest scores of accounting students using the traditional instruction method.

The null hypothesis was tested by comparing the achievement scores of the posttest calculated for students in the Control and Experimental groups. A two-tailed t-test was used to make the statistical comparison between the two groups' mean scores. The results of the statistical calculations appear as the t value of Table 3. The formula and data used in computing the t-score are presented in Appendix E.

The results presented in Table 3 indicate that there was not a significant difference between the experimental group and the control groups' posttest scores.

Using 61 degrees of freedom and a critical value of 2.00 (table at 60 df, 2 tail, significant level of .05), the resulting t-score was equal to .97. This result indicated that there is not a significant difference between the two

Table 3

Results of the Two-Tailed T-
Test Comparing Groups'
Posttest Scores

Source of Variation	Squares of Standard Deviation	Degrees of Freedom
Teaching Methods	16,479.58	61

Mean Differences	Critical Value	t-Score	Significance Level
4.07	2.00	.97*	.05

*Not significant at the .05 level

groups. The results allowed the researcher to accept the null hypothesis. Additional comparisons between the group means were not necessary since only two means were involved in this comparison.

Summary of Results

Results of testing the null hypothesis showed that of the two groups being compared neither group made significantly greater gains in the posttest scores.

Chapter 4

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine if the computer-assisted method of instruction was more effective than the traditional method of instruction in the teaching of accounting principles classes at the junior/community college level.

For this study, sixty-three (N=63) junior/community college students enrolled in the Principles of Accounting I course, Sections B and D, at Colby Community College at Colby, Kansas, during the fall semester of the 1979-80 academic year acted as subjects in the research which compared the effects of two different methods of teaching the basic concepts of the course. One group, the Experimental group (N=35) was taught by a computer-assisted method using the college's math and science data processing facility to assist in the learning activities. The second group, the Control group (N=28), was taught by the traditional method and was not allowed to use the computer in completing course assignments and learning exercises. The Russell-Sanders Bookkeeping Test, Text I-B, was administered to both groups on a pretest-posttest basis as a means of determining achievement gain scores. The summary of the data results, the conclusions drawn from the results, and recommendations are presented in the following sections.

Summary

Using a two-way ANOVA, the results indicated that the two groups, the computer-assisted group (experimental) and the traditional group (control), were not significantly different in the existing variables at the time of the study.

A two-tailed t-score was used to test the null hypothesis concerning the two student groups' posttest scores. The results of testing this null hypothesis was that neither the experimental group nor the control group had significantly greater gains in achievement on the posttest.

Conclusions

There is no significant difference between the posttest scores of accounting students using the computer-assisted instruction method and the posttest scores of accounting students using the traditional instruction method.

The conclusion presented in this section includes only that which can be logically stated from the results presented in Chapter 3. While this limited the number of conclusions that can be drawn, and while these results may be useful to those who teach accounting courses, the results should not be generalized to other student populations unless comparable student selection, teaching, and evaluation procedures are used.

Recommendations

Many research possibilities became apparent while this study was being conducted.

1. A similar experiment should be conducted using a larger number of subjects to determine if the same results would be obtained. The results of such a study would increase the generalizability of the findings.

2. Additional research should be conducted matching students by ability levels. The difference in variances would be more accurate as they would not be attributable to something other than difference in ability.

3. A study should be conducted using the same basic design for the course known as Accounting II following Accounting I taught by the traditional method. It is possible that once students have learned the basic concepts, the computer could be used effectively to perform routine repetitive procedures.

4. Accounting instructors should continue to seek means of obtaining high achievement gains while reducing the amount of time needed to be spent on outside class assignments.

5. A similar study should be conducted in other areas of the accounting curricula.

6. A study measuring the effect of integrating the use of the computer in beginning accounting should be done to determine the effect on student interest and motivation.

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APPENDIXES

APPENDIX A

ASSIGNMENT LIST

ASSIGNMENT SHEET

Chapter 2:	Exercises: 2-1, 2-3, 2-4 Problems: 2-1A, 2-4A
Chapter 3:	Exercises: 3-1, 3-4, 3-5, 3-6 Problems: 3-1A, 3-4A
Chapter 4:	Exercises: 4-1, 4-3, 4-4 Problems: 4-6A
Chapter 5:	Exercises: 5-2, 5-3, 5-4 Problems: 5-1A, 5-4A
Chapter 6:	Exercises: 6-2, 6-5, 6-6, 6-7, 6-8 Problems: 6-4A
Chapter 7:	Exercises: 7-1, 7-3, 7-6 Problems: 7-1A, 7-3A
Chapter 8:	Exercises: 8-2, 8-4 Problems: 8-1A, 8-5A
Chapter 9:	Exercises: 9-1, 9-2, 9-8 Problems: 9-2A
Chapter 10:	Exercises: 10-1, 10-2, 10-5 Problems: 10-3A, 10-5A
Chapter 11:	Exercises: None Problems: 11-1A

APPENDIX B

REVIEW PROCEDURE AND
SAMPLE PRINTOUTS

REVIEW PROCEDURE AND
SAMPLE PRINTOUTS

READY
RUN

LIND90 BA 4A

ENTER YOUR NAME AND DATE
?LINDA LINDEN, MAY 4, 1979
REVIEW THEORY OF CHAPTER 2
TURN ON AUTO-PRINT, PRESS RETURN

?

USE THE FOLLOWING INITIALS:
A=ASSETS, L=LIABILITTES, C=CAPITAL
D=DRAWING, R=REVENUE, E=EXPENSE
INC=INCREASE, DEC=DECREASE
DR=DEBIT, CR=CREDIT

USE IN THAT ORDER, NO SPACE AFTER COMMA
DO NOT USE PERIODS AFTER ABBREVIATIONS
SPELL OUT ACCOUNT NAMES IN FULL IN ENTRIES
WHAT IS THE ACCOUNTING EQUATION?

?A=L+C

RIGHT, PLEASE GO ON

SIMPLIEST FORM OF AN ACCOUNT IS WHAT?

?T-ACCOUNT

OKAY, GO ON

DEFINE DEBIT

?LEFT

GOOD, NEXT QUESTION

DEFINE CREDIT

?RIGHT

RIGHT, NOW FOR YOUR DR & CR RULES

INDICATE INC OR DEC FOR DR AND CR

A=

?INC,DEC

L=

?DEC,INC

C=

?DEC,INC

D=

?INC,DEC

R=

?DEC,INC

E=

?INC,DEC

GOOD, PLEASE GO ON

ANOTHER NAME FOR GENERAL JOURNAL IS?

?BOOK OF ORIGINAL ENTRY

GOOD, NEXT QUESTION

WHICH SIDE IS ALWAYS THE NORMAL BALANCE SIDE?

?INC:

OKAY, NEXT ONE
WHICH ARE YOUR PERMANENT ACCOUNTS?
?A,L,C
WHICH ARE YOUR TEMPORARY ACCOUNTS?
?D,R,E
GOOD, NEXT QUESTION
WHAT DOES THE TRIAL BALANCE PROVE?
?DR=CR
OKAY, NEXT QUESTION
WHAT ORDER ARE YOUR ACCOUNTS USUALLY IN?
?A,L,C,D,R,E
GOOD, PLEASE GO ON
AN EXPIRED COST DEFINES WHAT?
?E
SOMETHING YOU OWE OTHERS IS WHAT?
?L
SOMETHING YOU OWN IS WHAT?
?A
OWNER'S CLAIM TO THE BUSINESS IS WHAT?
?C
GOOD JOB, GO ON
WHAT WOULD YOU DEBIT IN THE FOLLOWING?
PAID \$500 FOR OFFICE SUPPLIES
?OFFICE SUPPLIES
PAID \$500 FOR OFFICE SUPPLIES
?OFFICE SUPPLIES
PAID \$2000 RENT FOR THE MONTH
?RENT EXPENSE
COLLECTED FEES OF \$10,090
?CASH
GOOD, WHAT ACCOUNTS WOULD YOU CREDIT NOW?
BOUGHT A \$10,000 AUTO ON ACCOUNT
?ACCOUNTS PAYABLE
INVESTED \$25,000 CASH IN THE BUSINESS
?CAPITAL
PAID \$200 FOR FIRE INSURANCE
?CASH
GOOD JOB, HAND IN PRINTOUT FOR CHECKING
AFTER THAT YOU MAY USE IT FOR REVIEW

READY
BYE

.0123

/ GET INPUT DATA

/
.R FRTS
*RXA1:PUNCH
CYCL1.DA</5

/ ECHO THE INPUT DATA

/
.LIST CYCL1.DA

JAMES TANGEMAN
TWIN CITY ANSWERING SERVICE

0111

APRIL 1979
85 275 02 275
13 30 02 30
23 450 40 450
71 28 02 28
01 375 08 375
39 150 02 150
53 300 02 300
87 39 02 39
07 915 58 915
89 15 02 15
87 33 02 33

0111

/
/

△ RUN THE CYCL1 PROGRAM

/
.R FRTS
*RXA1:CYCL1
*CYCL1.DA/2
*LPT:/5
RXA1:ACCTZ.DA/9

	RENT EXPENSE	275.00	
	CASH		275.00
	SUPPLIES	30.00	
	CASH		30.00
1111	EQUIPMENT	450.00	
	ACCOUNTS PAYABLE		450.00
	ADVERTISING EXPENSE	28.00	
	CASH		28.00
	CASH	375.00	
	ACCOUNTS RECEIVABLE		375.00
	ACCOUNTS PAYABLE	150.00	
	CASH		150.00
111	DRAWING	300.00	
	CASH		300.00
	UTILITIES EXPENSE	39.00	
	CASH		39.00
	ACCOUNTS RECEIVABLE	915.00	
	FEES EARNED		915.00
	MISCELLANEOUS OPERATING EXPENSE	15.00	
	CASH		15.00
1111	UTILITIES EXPENSE	33.00	
	CASH		33.00
	TOTALS FOR THIS DATE	2610.00	2610.00

TWIN CITY ANSWERING SERVICE
 DEBITS AND CREDITS BY ACCOUNTS
 APRIL, 1979

CASH		ACCOUNTS RECEIVABLE		SUPPLIES
375.00		915.00		30.00
	275.00		375.00	
	30.00			
	28.00			
	150.00			
	300.00			
	39.00			
	15.00			
	33.00			
EQUIPMENT		ACCOUNTS PAYABLE		DRAWING
450.00		150.00		300.00
			450.00	
FEEs EARNED	915.00	ADVERTISING EXPENSE		RENT EXPENSE
		28.00		275.00
UTILITIES EXPENSE		MISCELLANEOUS OPERATING EXPENSE		
39.00		15.00		
33.00				

JAMES TANGEMAN

TWIN CITY ANSWERING SERVICE

TRIAL BALANCE

APRIL, 1979

CASH		495.00
ACCOUNTS RECEIVABLE	540.00	
SUPPLIES	30.00	
EQUIPMENT	450.00	
ACCOUNTS PAYABLE		300.00
DRAWING	300.00	
FEES EARNED		915.00
ADVERTISING EXPENSE	28.00	
RENT EXPENSE	275.00	
UTILITIES EXPENSE	72.00	
MISCELLANEOUS OPERATING EXPENSE	15.00	
	-----	-----
	1710.00	1710.00
	-----	-----
	-----	-----

APPENDIX C

RAW SCORES

RAW SCORES

Experimental GroupControl Group(Section B)
N=35(Section D)
N=28

85	40
85	40
85	38
83	37
81	34
81	27
81	
79	
79	
73	
71	
68	
67	
62	
62	
57	
57	
55	
54	
52	
51	
50	
50	
49	
47	
44	
43	
42	
41	

87
84
81
69
67
65
65
65
63
58
56
55
54
53
53
52
51
51
49
48
46
45
40
38
38
35
34
24

Total Possible Score = 90

APPENDIX D

TWO-WAY ANOVA STATISTICAL TEST

TWO-WAY ANOVA

 X_a (Section B)

$$\begin{aligned} EX &= 2050 \\ n &= 35 \\ EX^2 &= 130,382 \\ X &= 58.57 \end{aligned}$$

 X_b (Section D)

$$\begin{aligned} EX &= 1526 \\ n &= 28 \\ EX^2 &= 89,336 \\ X &= 54.50 \end{aligned}$$

$$S_a^2 = \frac{EX^2 - (X)(EX)}{n-1}$$

$$S_b^2 = \frac{EX^2 - (X)(EX)}{n-1}$$

$$S_a^2 = \frac{130,382 - (58.57)(2050)}{34}$$

$$S_b^2 = \frac{89,336 - (54.50)(1526)}{27}$$

$$S_a^2 = \frac{130,382 - 120,068.5}{34}$$

$$S_b^2 = \frac{89,336 - 83,167}{27}$$

$$S_a^2 = \frac{10,313.5}{34} = 303.34$$

$$S_b^2 = \frac{6,169}{27} = 228.48$$

$$F = \frac{303.34}{228.48} = 1.33 \quad df = \frac{34}{27} \text{ (Table 30/27)}$$

$$CTV = 1.88 < .05$$

As $1.33 < CTV$ of 1.88 , Variances are Homogeneous

APPENDIX E

TWO-TAILED t -TEST
STATISTICAL TEST

TWO-TAILED t -TEST

$$S_{x_a - x_b} = \sqrt{\left(\frac{EX_a^2 + EX_b^2}{N_a + N_b - 2} \right) \left(\frac{1}{N_a} + \frac{1}{N_b} \right)}$$

$$\begin{aligned} EX_a^2 &= 130,382 - \frac{(2050)^2}{35} \\ &= 130,382 - 120,071.42 \\ &= 10,310.58 \end{aligned}$$

$$\begin{aligned} EX_b^2 &= 89,336 - \frac{(1526)^2}{28} \\ &= 89,336 - 83,167 \\ &= 6.169 \end{aligned}$$

$$= \sqrt{\left(\frac{10,310.58 + 6.169}{35 + 28 - 2} \right) \left(.029 + .036 \right)}$$

$$= \sqrt{\left(270.16 \right) \left(.065 \right)}$$

$$= \sqrt{17.6}$$

$$= 4.2$$

$$t = \frac{58.57 - 54.5}{4.2}$$

$$= \frac{4.07}{4.2}$$

$$= .969$$

As t of .97 < CTV of 2.00 (Table at 60 df, 2 tail, $\alpha .05$) \therefore
Accept H_0