

COMPUTER-ASSISTED INSTRUCTION IN A PROFITABLE  
MERCHANDISING ANALYSIS CLASS

By

TERESA L. SMITH SHELL  
//

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1974

Submitted to the Faculty of the Graduate College  
of the Oklahoma State University  
in partial fulfillment of the requirements  
for the Degree of  
MASTER OF SCIENCE  
December, 1975

Thesis  
1975  
5544c  
cop. 2

MAR 24 1976

COMPUTER-ASSISTED INSTRUCTION IN A PROFITABLE  
MERCHANDISING ANALYSIS CLASS

Thesis Approved:

*Gronalynn Siler*

Thesis Adviser

*Kathryn M. Drummond*

*Lara Cacy*

*D. N. Newton*

Dean of the Graduate College

935083

## ACKNOWLEDGEMENTS

The writer wishes to express her appreciation to her major adviser, Dr. Grovalynn Sisler, for her guidance, assistance, and time given throughout the study. Appreciation is also expressed to the other committee members, Dr. Kathryn Greenwood and Dr. Lora Cacy for their assistance and cooperation in the preparation of the final manuscript.

A special note of thanks is given to Mr. Eldean Bahm for his assistance in preparing the unit. Thanks is also extended to Mrs. Anna Gleason for the excellence of the final copy and for her additional assistance.

Special gratitude is expressed to Frank and Helen Shell, for their help in proofreading and typing, and for their encouragement. The writer also extends much appreciation to her mother, Mrs. Maxine Forester for making her education possible. Finally, special thanks and love are expressed to the writer's husband, Bob, for his help, encouragement, and patience throughout the study.

## TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION . . . . .	1
Objectives of the Study . . . . .	2
Procedures . . . . .	3
Description of the Sample . . . . .	3
Limitations of the Study . . . . .	3
Definitions of Terms . . . . .	4
II. REVIEW OF LITERATURE . . . . .	5
Modes of Computer Usage . . . . .	6
Computer Terminals . . . . .	9
Development of a Computer Program . . . . .	10
Research in Computer-Assisted Instruction . . . . .	11
Advantages of Computer-Assisted Instruction . . . . .	16
Disadvantages of Computer-Assisted Instruction . . . . .	17
Summary . . . . .	18
III. METHODOLOGY . . . . .	19
Description of Sample . . . . .	20
Description of Course . . . . .	20
Development of the CAI Unit . . . . .	20
Developing a Pilot Unit . . . . .	21
Developing the Major Unit . . . . .	22
Generating the Program . . . . .	26
Instruments Used in Correlation . . . . .	27
Attitude Form . . . . .	28
Description of Mathematics Pretest . . . . .	29
American College Test (ACT) . . . . .	29
Coopersmith Self-Esteem Inventory . . . . .	29
Treatment of the Data . . . . .	30
IV. ANALYSIS OF DATA . . . . .	31
Student Attitudes and Evaluation . . . . .	31
Evaluation of CAI Unit . . . . .	31
Student Attitudes . . . . .	34
Results of Correlation . . . . .	35
Cost Analysis . . . . .	35

Chapter	Page
V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS . . . . .	37
Recommendations for Further Study . . . . .	39
A SELECTED BIBLIOGRAPHY . . . . .	40
APPENDIX A - ATTITUDE QUESTIONNAIRE CONCERNING COMPUTER LESSON . . . . .	43
APPENDIX B - OUTLINE OF MATHEMATICS PRETEST . . . . .	46
APPENDIX C - COURSE CONTENT FOR PROFITABLE MERCHANDISING ANALYSIS - SPRING, 1975 . . . . .	48
APPENDIX D - GENERAL INFORMATION SHEET ON "UNIT OPEN-TO-BUY" .	50
APPENDIX E - COMPUTER INSTRUCTIONS . . . . .	53
APPENDIX F - EXERPT FROM COMPUTER PROGRAM . . . . .	56
APPENDIX G - COOPERSMITH SELF-ESTEEM INVENTORY . . . . .	59
APPENDIX H - HINTS FOR WORKING SUMMARY PROBLEMS . . . . .	63
APPENDIX I - RAW SCORES OF PARTICIPANTS . . . . .	66
APPENDIX J - RECOMMENDATIONS FOR REVISION OF PROGRAM . . . . .	69

LIST OF TABLES

Table	Page
I. Total Responses of 40 Students on the CAI Attitude Form . . . . .	32
II. Correlation of CAI Test Scores with Six Selected Variables . . . . .	36

LIST OF FIGURES

Figure	Page
1. Sample Flow Chart . . . . .	12
2. Flow Chart of Problem One . . . . .	23
3. Flow Chart of Problem Two . . . . .	24

## CHAPTER I

### INTRODUCTION

One of the primary concerns of educators today is the individualization of the learning process (20, p. 12). "Individualized education is essentially the adaption of instructional practices to individual requirements" (5, p. 57<sup>4</sup>). Information presented in this way allows the student to learn at his own pace according to his ability level. Among the variety of methods devised to accomplish this goal is computer-assisted instruction. Research of recent years has indicated that the use of computers is a quick, effective way of presenting individualized instructional materials. "One of the primary aims of computer-assisted instruction is to optimize the learning process. This is implicit in the concept of individualized instruction" (2, p. 76).

During the 1960's, computers were used in education for reports, record keeping, test grading, and other time consuming tasks. In the late 60's and early 70's, educators began to focus their attention on the instructional capabilities of computers. Since then many studies have been conducted which further enhance the educational uses of computers. Results indicate that 1) computers are an effective method of supplying individualized instruction, 2) computers save instructor time by grading tests, keeping records and providing reports on student progress, 3) students can progress as rapidly as they can comprehend, therefore saving them time, 4) students receive



immediate feedback, 5) students suffer no public embarrassment such as is possible in the classroom, and 6) computers are impartial; never impatient (11, p. 103). Other advantages may be discovered in the future.

### Objectives of the Study

The overall objective of this study was to develop and evaluate a tutorial computer-assisted instructional unit for use in Profitable Merchandising Analysis, a senior course in the Clothing, Textiles, and Merchandising Department.

Specific objectives formulated for the study were to:

1. develop a computer-assisted instructional unit over one concept in the course and a 20 point test over that unit,
2. correlate scores on the test over the computer-assisted instructional unit with the following:
  - Computer-assisted instruction (CAI) attitude scores
  - Mathematics pretest scores
  - American College Test (ACT) mathematics scores
  - Coopersmith Self-Esteem Inventory scores
  - Average scores on all other unit tests in the course
  - Final grades in the course
3. evaluate the content of the computer-assisted instructional unit and make recommendations for revision, and
4. determine cost and time used in developing and administering the computer-assisted instructional unit.

## Procedures

The selected unit in the course was developed and programmed for computer-assisted instruction. Students utilized the program and completed the 20 point test over the unit. Scores listed in objective two above were collected and correlations between scores on the test over the computer-assisted instructional unit and scores on the other instruments were made using the Spearman Rank Order Coefficient of Correlation.

Evaluation of the content of the computer-assisted instructional unit was based on comments and reactions of students during the lesson and on student reactions to Part A of the attitude form (Appendix A, p. 44).

## Description of the Sample

Participants in the study were the 44 students enrolled in Profitable Merchandising Analysis, Spring 1975. Four of the 44 students were eliminated because two were unable to complete the CAI unit and two dropped out of the course before the end of the semester.

## Limitations of the Study

Only one concept from the Profitable Merchandising Analysis course, "Unit Open-to-Buy," was used for the analysis. Only one method of instruction, computer-assisted instruction, was investigated. All students were required to complete the unit within a one-week time period.

ACT scores for only 25 students were available, so the correlation between ACT scores and CAI test scores was limited to those 25 students.

### Definition of Terms

ACT mathematics scores are scores received on the mathematics section of the American College Test.

Computer is an electronic machine which is able to perform arithmetic and logical operations in sequence and in accordance with pre-programmed instructions (11, p. 103).

Computer-assisted instruction (CAI) is any situation in which the computer is used in the instructional process (27, p. 57). Computer-assisted instruction will hereafter be referred to as CAI.

CAI attitude scores are scores received on the computer-assisted instructional attitude form developed by the researcher.

CAI test refers to the 20 point test over the CAI unit which was given after completion of the unit.

CAI unit is the "Unit-Open-to-Buy" section of the course which was programmed for the purpose of providing individualized instruction.

Mathematic pretest scores are scores received on the pretest over general mathematical calculations which was given at the beginning of the course. A description of the test appears in Appendix B, p. 46.

Program is a sequence of instructions to be carried out by the computer (27, p. 57).

## CHAPTER II

### REVIEW OF LITERATURE

Ten years ago the use of computers in instruction was only an idea that was being considered by a few scientists and educators. By 1968 that idea had become a reality (2, p. 73). Atkinson and Wilson (2, p. 74) listed four factors which influenced the rapid growth of computer usage in education.

1. The potential of computers for supplying today's most pressing need in education: individualization.
2. The development of programmed instruction.
3. The mushrooming of electronic data processing in general.
4. Increasing aid to education by the Federal Government.

These factors continue to influence education today. Solomon (23, p. 39) cited the influence of these factors when he wrote ". . . the integration of electronic data processing and programmed instruction is capable of leading to more efficient and effective material presentation." Reed, Ertel, and Collart (20, p. 12) reinforced the idea.

Electronic information processing, specifically computer-assisted instruction, is a method which may be of help to teachers in various types of institutional settings who attempt to individualize learning experiences.

Educators today recognize several possibilities for the use of computers as instructional devices. Many have conducted studies

involving various kinds of computer use in education. Mitchell (18) used computer simulation in a college course. Hayman and Mable (10) conducted a study in the use of computer managed instruction. Suppes and Morningstar (25) explored computer-assisted instruction and problem solving. These and other studies have contributed to greater computer usage in education.

#### Modes of Computer Usage

There are a number of different ways to use a computer as an instructional tool. Schoen (21, p. 54) has categorized the methods as:

1. Problem solving
2. Simulation
3. Computer managed instruction
4. Computer assisted instruction
  - a. Drill and practice
  - b. Tutorial
  - c. Dialogue

Problem solving consists of a student or instructor using a computer as a device to solve a complex problem. The learning situation is not directly controlled by the computer. The student may direct a computer to calculate a mathematical problem or translate a foreign language if it is programmed for such uses.

Computer simulation creates a real-life situation through which the student is able to learn. The student participates in simulation by making decisions and entering these into the computer. The computer then reveals circumstances which follow a decision. If the

student wishes, he can try the simulation again, and make different decisions to try to reach a different goal. Airplane landings, economic systems, and even horse racing have been simulated by computers.

"When a computer is used in conjunction with an individualized instruction system for purposes of record keeping and test scoring, the term computer managed instruction is employed" (21, p. 54). This type of system guides a student, but does not instruct him. The computer keeps a record of the student's progress, prints reports for the instructor, and advises the student on his next lesson. In this type of program, various types of media are needed. The computer evaluates the student and refers him to materials for which he is ready. Hayman and Mable (10) found this type system very effective in the College of Education at Pennsylvania State University. The following advantages of using computer managed instruction were identified:

1. Eliminates hours of mental gymnastics necessary for the accurate computation of multiple evaluation types.
2. Frees the professor for individual evaluation necessary in a competency based course.
3. Removes the risk of professor-student favoritism.
4. Provides concrete data for such decision-making as deferred grades, late drops, references to student performance, student conferences, etc. (10, p. 62).

Computer managed instruction has been proven to be an effective aid to teachers and students alike. However, as with all computer usage, computer managed instruction is expensive. It is more costly than traditional instruction. Thus, the advantages must be weighed

against the disadvantages concerning the cost of the operation.

Computer-assisted instruction (CAI) utilizes the computer as a teaching device. Tennyson (26, p. 50) defined CAI as ". . . the direct use of computers as disseminators of knowledge to learners." In the case of CAI, the student communicates directly with the computer through the terminal supplied to him. The student may simply read material supplied by the computer or he may answer questions about a certain subject.

A frame of information followed by a question is presented to the student either on the typewriter or on the display (CRT or plasma display tube). The student responds via the typewriter, or with light pen, and based on his response data, he receives feedback concerning his answer followed by further information (21, p. 54).

Three methods of utilizing CAI are recognized.

1. Drill and practice
2. Tutorial
3. Dialogue

The drill and practice program is the simplest of the three methods. The computer simply gives the student a problem to work, and grades him immediately after he has responded. It then presents another problem to him. When all problems have been worked, the computer prints the student's score. This type program is especially suited to spelling or mathematics. The student can practice until he feels proficient in the skills desired.

The tutorial method of instruction involves the computer as a direct teaching tool. "A tutorial system is essentially a self-contained educational unit, as the main responsibility for instruction shifts from the teacher to the computer" (23, p. 39). This method

requires more programming, more time, and more money than other CAI methods. Tutorial instruction lends itself to almost any subject.

The dialogue mode of instruction is still in the developmental stage. In the future, it is predicted that humans will be able to speak to the computer and have the computer respond verbally. This may help overcome the problem of the poor reader in using CAI.

### Computer Terminals

Computer terminals are devices used for communication between computers and students. Several types of terminals are available:

1. Simple terminal configurations consist of teletype (typewriter) terminals connected by telephone wires to a central computer. Also, under this category, a telephone with a touch pad connected to the computer is sometimes used.
2. An intermediate terminal configuration is one which includes, in addition to the teletype, various audio visual devices for optical projection and audio reproduction.
3. A complex terminal configuration includes a CRT (cathode ray tube), audio and film display, teletype and light pen. The student may respond either on the teletype or via the CRT, using the light pen (27, p. 57).

The typewriter terminal is most frequently used. Advantages of this type of terminal are that it provides a paper record of what the student has already learned and it costs less than other terminals. A disadvantage is that it types out information slowly.

A cathode ray tube has several advantages: 1) material is printed quicker, 2) response is a simple touch of the light pen to the screen, and 3) the tube is silent. However, the cathode ray tube does not supply a written record of the lesson to the student. Dick and Latta (7, p. 28) speculated that the lack of a written record



may have kept low ability students from performing well on the cathode ray tube used in their study. This type of terminal is also more expensive than the typewriter terminal.

#### Development of a Computer Program

The developer of a CAI program may either program the material himself or write the material and have it programmed by a computer programmer. Short courses, programming consultants, books, and articles are available for a teacher who wishes to learn to program the computer himself.

The developer of a CAI program should be a person who:

1. has mastered the proposed content,
2. understands the proposed content, and
3. accepts the challenge of working with a new educational medium (20, p. 12).

A person with these characteristics will probably be able to produce effective CAI programs.

After consideration of the type of computer program needed, the developer should write clear objectives over the subject matter he wishes the program to present. Following the objectives, he should make a detailed outline of the material. He then should divide the program into instructional segments or units of instruction. If he is using a branching technique, where students take different "tracts," the developer must also consider "core content." Core content is the basic knowledge essential to every student who takes the program.

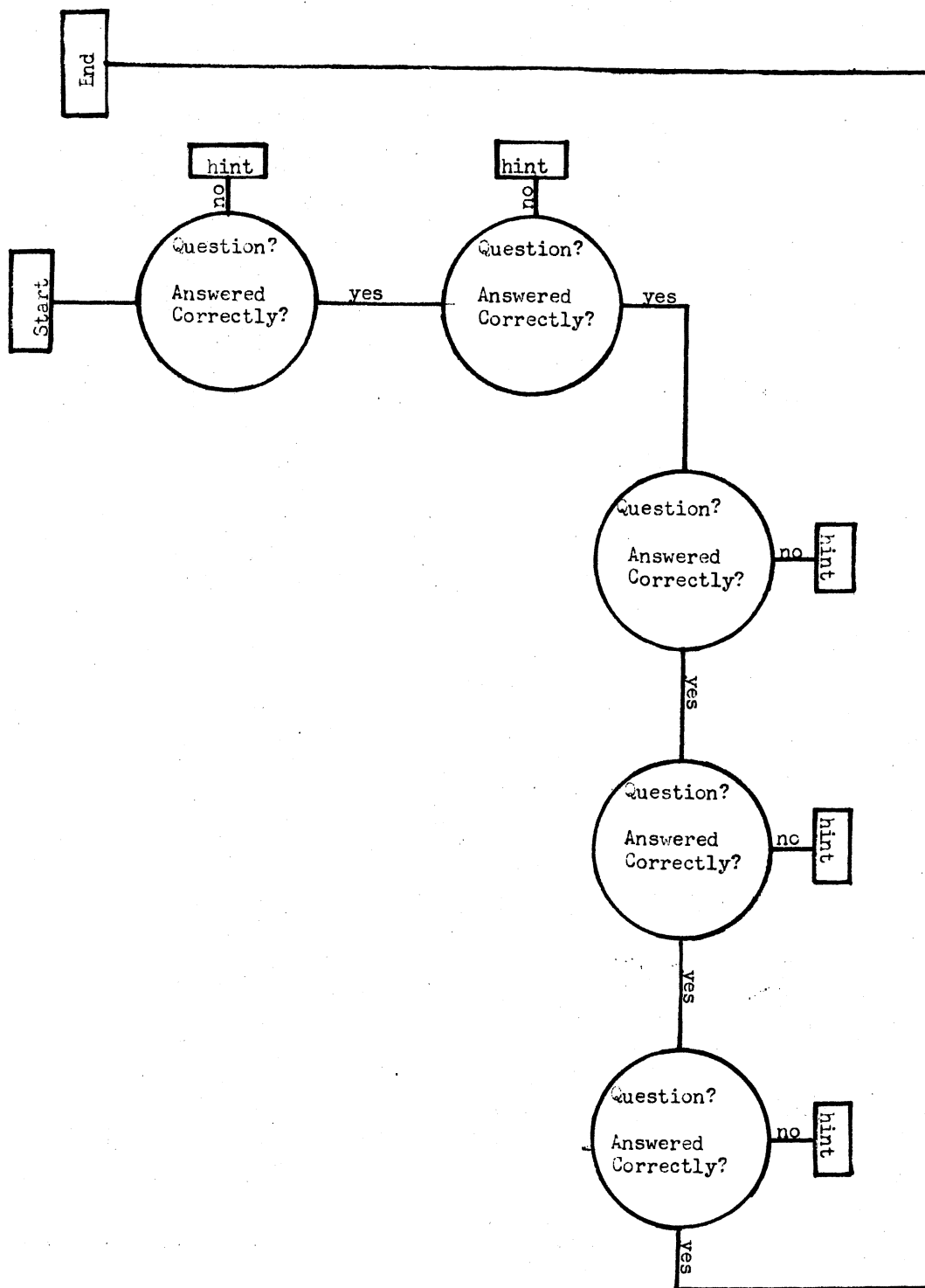
After completing these steps, the developer is then ready to write his program including any sequences, questions, or problems

which will be programmed into the computer. Reed, Ertel, and Collart (20, p. 13) advised writing core content first and adding modifications later. If the developer is having the lesson programmed, he should work closely with the programmer. If he is programming the lesson himself, he should design a flow chart such as the example (Figure 1) to organize the instructional materials.

After the lesson has been written and programmed, a reviewer should evaluate it. The reviewer looks for unclear areas and areas of questionable accuracy. The developer may use suggestions from the reviewer in modifying the program. The lesson should also be previewed by several students representative of those planning to take the lesson. They may offer a different viewpoint, and their suggestions may also be helpful in revising. After revision, the program is ready for execution.

#### Research in Computer-Assisted Instruction

With the advent of computers, research in CAI began. Computer-assisted instruction has been studied in almost every area of education. Suppes and Morningstar (25) conducted a CAI program for a college Russian course. In the course, the computer was used for class instruction. Two sections served as the control group and two others served as the experimental group. The control group attended traditional lecture method classes, while the experimental group received all lessons from a computer. In addition, all students spent time in the language laboratory and did homework assignments. Evaluation was performed by periodic tests and a final examination. Results of this study indicated that 74 per cent of the computer-based class



Source: (27), p. 52.

Figure 1. Sample Flow Chart

performed better on the final examination than the best student of the conventional class. The average number of errors was 53.0 for the computer-based class while the average number of errors for the class of conventional students was 71.1.

Longo and Guinte (15) found similar results from their studies conducted at the U. S. Army Signal Center and School. In an initial study in 1968, 11 hours of basic electronics were taught to two groups of students. The control group learned by conventional lecture teaching and the experimental group learned via CAI. Results showed that the CAI group completed its training in 10.8 per cent less time and showed equivalent achievement in comparison with the control group. In a similar follow-up study in 1969 the training time of the CAI group was reduced 20.1 per cent as compared to the control group's time. A final study involved four weeks of training in basic electronics. A control group and experimental group were used in this situation also. Results showed that CAI students training time was 16 per cent less than the control group. Longo and Guinte also noted that nearly all students had good attitudes towards CAI.

CAI has been used for several different subjects in elementary schools. Scrivens (22) reported on the INDICON project in Waterford Township School District, Pontiac, Michigan. The project involved CAI at both the elementary and secondary levels. Scrivens found that CAI classes exhibited greater achievement than did non-CAI classes. Also student attitudes towards CAI improved.

Mathematics is a subject in which CAI studies have been conducted at all educational levels and in many different areas. Suppes and Morningstar (25) conducted a drill and practice program in elementary

school mathematics in California. Students in the program were given a pretest at the beginning of the program. The program consisted of drills and re-drills for the students. At the conclusion of the program, posttests were given. Evaluation was performed by administering the Stanford Achievement Test (SAT). Results indicated that students in grades 2, 3, 5, and 6 who had received computer-based drill and practice had significantly greater performance levels on sections of the SAT than did the control group of students. Suppes and Morningstar noted that with an additional half hour a day in mathematics drills by the instructor, the same results could be obtained. However, most teachers cannot provide the time for extra drills. Therefore, CAI is an effective method of providing this drill.

Weiner, Malkin, Helm, and Howell (28) conducted a similar drill and practice program at the elementary mathematics level. The study was conducted in New York City with sixteen schools using CAI and four schools not using CAI. Results indicated that CAI students made significantly greater gains in the mathematics area. All students had favorable attitudes towards CAI.

College level CAI studies are numerous. Hall (9) conducted a mobile program designed to teach modern mathematics teaching methods to elementary school teachers in the Appalachian region. An achievement test was given to evaluate learning. The average performance of students advanced from 53 per cent on the pretest to 73 per cent on the posttest. Hall noted that the best demonstration of a positive attitude toward CAI was the interest in working on the computer later than regular study hours.

Also at the college level, Young (30) used a drill and practice type of program in a Quantitative Methods course. The student was presented with specific objectives and problems by the computer. Young concluded that the work the students put into the course and concomitantly their performances were considerably greater. This conclusion was evidenced by the fact that the CAI group received higher scores on examinations. Young also felt that his relationship with students was improved because students no longer negotiated with the instructor for grades; they had to meet objectives.

Solomon (23) conducted a tutorial CAI program dealing with a college level accounting principles course. The instruction of the students was actually on the computer terminal. Results showed that learning time via the computer was less than through the conventional method of instruction. In addition, the CAI method was as effective as the conventional method of instruction.

Atkinson and Wilson (2) have experimented with different types of CAI with great success. A tutorial CAI system was established at Brentwood Elementary School in East Palo Alto, California. After two years of operation, four hundred students had received a major part of their daily lessons in reading or mathematics via the tutorial CAI system. Significant gains in student achievement were observed in each of the two years of operation. A drill and practice system was also established by Atkinson and Wilson in 1965. By 1967-68 nearly 3000 students had received drill in arithmetic, spelling, logic, and Russian. Students under the program were from the Stanford area and from as far away as Morehead, Kentucky. This system was also rated extremely effective.

Researchers have reported success with CAI. They have found student achievement to be as good or better than with conventional instruction. Researchers have also reported positive student attitudes toward CAI.

#### Advantages of Computer-Assisted Instruction

A number of advantages of CAI have been cited. Perhaps the most important of these is the individualization of the learning process.

For years educators have wanted to improve education in order to improve learning. They found that the key factor for improving learning is improving the learning environment (3, p. 16). Individualizing instruction was found to be one method of improving the learning environment. As a result of efforts to individualize instruction CAI was developed. Student control of his learning environment through CAI should facilitate his learning.

A properly constructed, student controlled, computer-related learning environment is a positive learning environment, because students can move within the classroom and can interact with a variety of interesting learning options (even in an artificial, school based environment) in a manner similar to the way they learn in a good non-school situation (3, p. 17).

Another advantage to CAI is the time-saving capability. Instructor time is saved by having the computer perform tasks such as grading papers and lecturing. Study time is also reduced, therefore saving student time.

Immediate feedback is also an advantage of CAI. The student knows immediately whether his answer is correct. If it is not correct, the computer provides remedial information. If his answer is correct, he has the immediate satisfaction of knowing he calculated correctly.

The computer also enables the student to ask questions or give answers without fear of embarrassment. As more research is conducted other advantages may be discovered.

#### Disadvantages of Computer-Assisted Instruction

The main disadvantage of CAI is the high cost. Although it varies from school to school, the cost of CAI is usually considered quite high. CAI expenses include not only computer charges but also charges for terminals, programmers, trained staff and software. Software includes all programs used to control a computing system and/or to meet the users end needs. Professional people have been and will continue to work together to reduce costs, therefore making CAI more feasible for the future. As for now, only schools which can afford such expenses are able to make use of CAI.

Another disadvantage of CAI is teacher reluctance to use the system. Some teachers are afraid that the system will replace them; however, those who have worked with CAI find that this fear is not justified. The teacher is definitely needed by students, but his role changes slightly. Instead of being a distributor of information and a disciplinarian, he becomes an individualized helper. He can work with students on a one-to-one basis to help them correct their learning problems because he has more time to devote to each student. These and other disadvantages may be corrected with further experience with and development of CAI.



### Summary

The introduction of computers in education has resulted in extensive research with various teaching methods. Problem solving, simulation, computer managed instruction, and computer-assisted instruction each have been used successfully.

Problem solving involves use of computers to solve calculations or problems. Simulation helps create real-life learning situations for students. Use of a computer to guide students to various media is termed computer managed instruction. Three types of computer-assisted instruction are drill and practice, tutorial, and dialogue. The drill and practice method of CAI drills students on problems to help them with rote learning. Tutorial CAI utilizes a computer as a direct teaching tool used to transmit knowledge to learners. Development of dialogue CAI has not been completed as yet; however in the future it will enable the student to speak with the computer.

Each of the modes has advantages and disadvantages. Individualization, immediate student feedback, and time saving are advantages common to each mode. A common disadvantage is cost. In order to select the most appropriate mode of instruction, all methods should be closely examined and compared for advantages and disadvantages in the specific situation.

## CHAPTER III

### METHODOLOGY

The overall objective of this study was to develop and evaluate a tutorial computer-assisted instructional unit for use in Profitable Merchandising Analysis, a senior course in the Clothing, Textiles, and Merchandising Department.

Specific objectives formulated for the study were to:

1. develop a computer-assisted instructional unit over one concept in the course and a 20 point test over that unit,
2. correlate scores on the test over the computer-assisted instructional unit with the following:
  - Computer-assisted instruction (CAI) attitude scores
  - Mathematics pretest scores
  - American College Test (ACT) mathematics scores
  - Coopersmith Self-Esteem Inventory scores
  - Average scores on all other unit tests in the course
  - Final grades in the course
3. evaluate the content of the computer-assisted instructional unit and make recommendations for revision, and
4. determine cost and time used in developing and administering the computer-assisted instructional unit.

### Description of Sample

Participants in this study were the students enrolled in Profitable Merchandising Analysis, Spring 1975. Originally 44 students were enrolled; however, four were dropped from the study because two were unable to take the CAI unit and two dropped out of the course before the end of the semester. Scores were obtained for the remaining 40 students for all variables except the ACT mathematics scores. ACT mathematics scores were not available for fifteen students, therefore scores of only 25 students were used in this calculation.

### Description of Course

Profitable Merchandising Analysis is one of the professional courses required of all students in the Fashion Merchandising degree plan within the department of Clothing, Textiles, and Merchandising. Students generally enroll in the course during their senior year. A course description is included in Appendix C, p. 48. Profitable Merchandising Analysis is scheduled to meet three times a week for one hour class periods. Traditionally the class has been taught by the lecture-discussion method. Evaluation in the course consisted of (1) 20 point tests over each of 16 units, (2) a basic mathematics pretest, (3) a mid-term examination, and (4) a final examination.

### Development of the CAI Unit

Because of the widely varying mathematical abilities and backgrounds of the students in the course it seemed desirable to move toward individualization of the instruction provided in the course. Since many researchers have reported success with CAI in various

classes dealing with mathematics, CAI was selected as the method of instruction for the study.

A basic knowledge of computer programming was needed in order to develop the CAI unit for the study. Thus it was necessary for the researcher to attend seminars in basic programming techniques and to learn to program the computer using the CPS/PL1 language.

#### Developing a Pilot Unit

In order to develop an effective program for the unit evaluated in the study, a pilot unit was programmed over the concept "Calculation of Gross Margin" and a pilot study was conducted. Objectives for the unit were developed. From these, an outline was constructed and the unit was written. Four types of problems requiring calculation of gross margin and an analysis of the steps involved in the computations were included in the unit. A tutorial format was selected for the unit which consisted of instructions, information, and questions for the students to answer in order to interact with the computer.

After the development of the subject matter content for the unit, the researcher programmed the unit on the computer. A typewriter terminal was used in programming the unit.

When the programming was completed, a person unfamiliar with the subject was asked to review and evaluate the unit using the computer. Several revisions were made on the basis of the trial run and the unit was considered ready for use. Twenty-five students from the Profitable Merchandising Analysis class volunteered to participate and evaluate this pilot unit. These students were not required to attend class lecture on the same subject but were permitted to attend class

if they desired. This pilot study was conducted for the purpose of evaluation of the format and the programming and no attempt was made to determine the effectiveness of the unit.

After completion of the unit, students were asked for suggestions for improvement of the program. Most recommended that instructions to students be made more clear and more detailed. Students felt that some hints and comments provided by the computer failed to explain the problems adequately. These recommendations were utilized in the development of the final CAI unit used in this study.

#### Developing the Major Unit

The topic "Unit Open-to-Buy" was selected for the CAI unit used in the study. Objectives were written and an outline of the subject matter was developed. The content was organized according to the two problems presented in the unit.

The format used for development of this unit was similar to the format for the pilot unit which consisted of instructions, information, and questions. The first half of the unit was developed, then programmed and tested for clarity on the computer. Revisions were made and the remainder of the unit was written and programmed.

Flow charts of the two problems (Figures 2 and 3) were constructed to illustrate the logical flow of information. Figure 2 illustrates the flow of problem number one in the unit while Figure 3 illustrates problem number two. The flow charts indicate the direction of progression through the unit according to answers given by the student. Symbols on the charts illustrate questions asked the student, correct and incorrect answers given and explanations for incorrect answers.

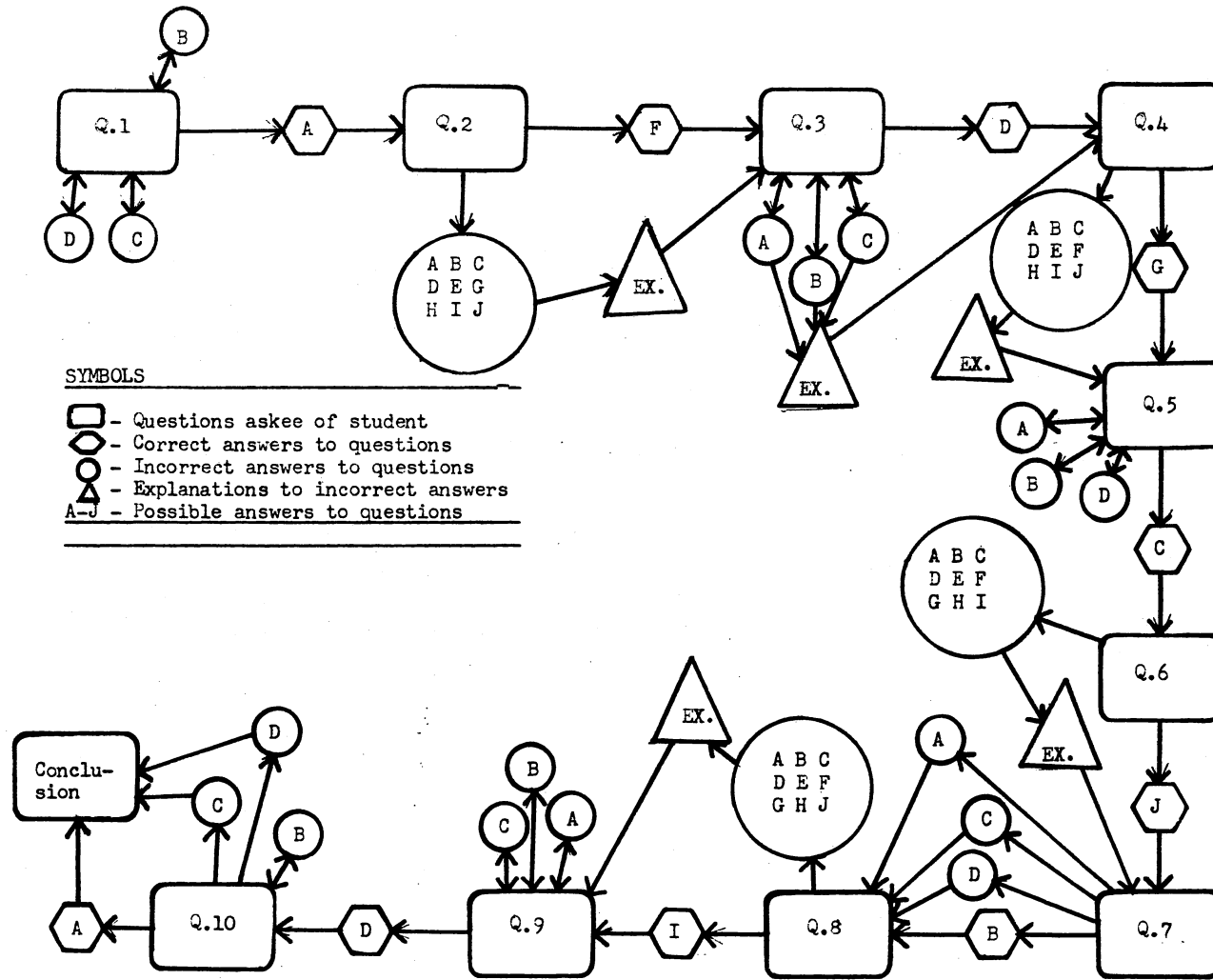


Figure 2. Flow Chart of Problem One

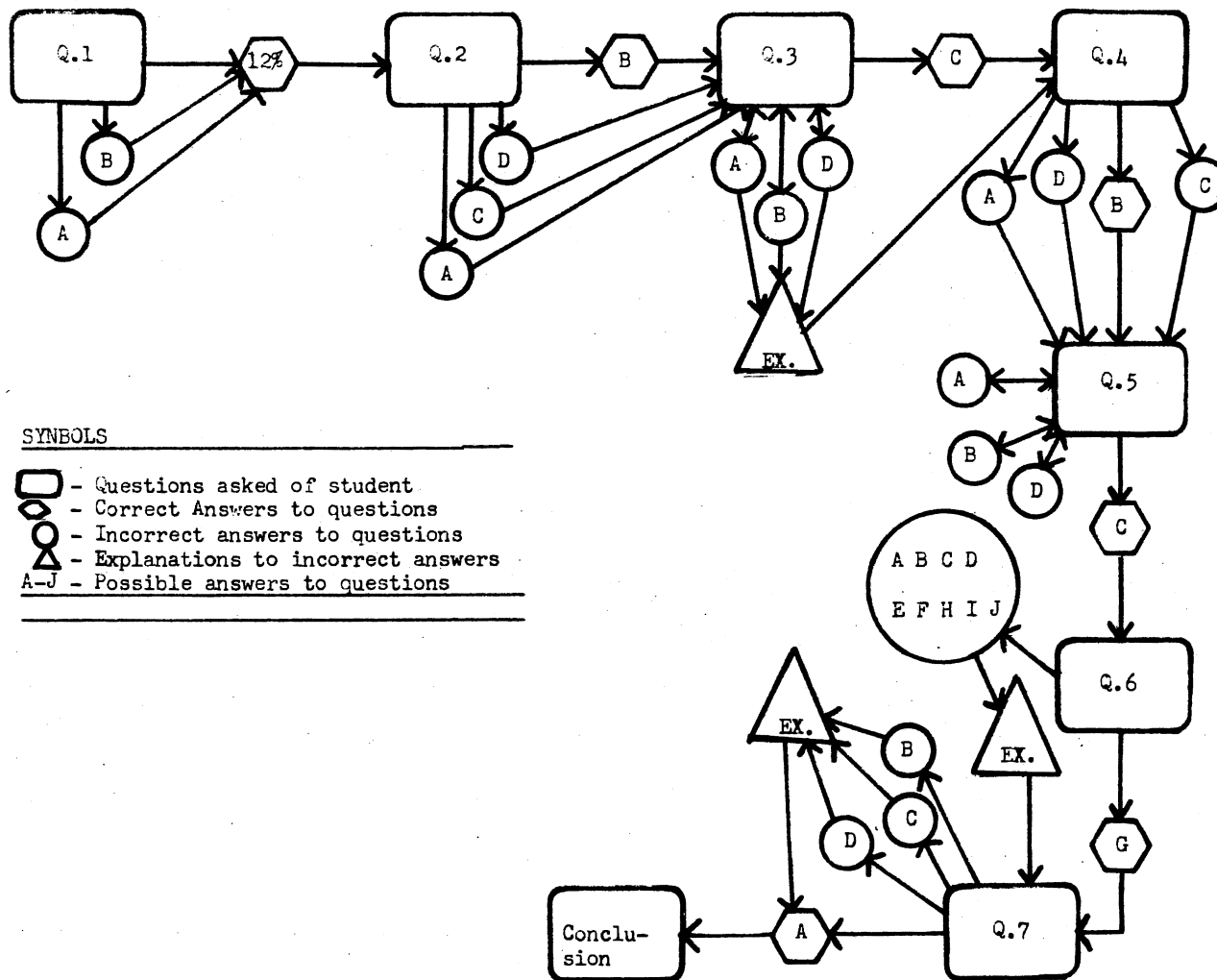


Figure 3. Flow Chart of Problem Two

The letters A-J symbolize all possible choices of answers a student could give.

All answers used as distractors were determined by predicting possible mistakes a student might make in the calculation of problems. For example if he multiplied when he should have divided, the product of the multiplied numerals was used as a distractor. By using logical distractors, a specific explanation could be provided for all incorrect answers. All incorrect answers are indicated by circles on the flow chart. Arrows adjoining the circles indicate whether the student is directed back to re-figure the problem and select another answer or given an explanation of the calculation. If the student was directed back to the question, he was informed why his first answer was incorrect. On several questions the student was given two opportunities to answer the question and then, if still unable to answer correctly, was given an explanation of the calculation. The arrows in the flow charts indicate the flow of information throughout the two problems presented in the unit.

When the programming of the remainder of the unit was completed, a reviewer was asked to evaluate the clarity of the unit. Slight revisions were made as a result of this evaluation.

A general information sheet (Appendix D, p. 50) was developed and given to students a week before the implementation of the CAI unit. The sheet included information on the location of the typewriter terminal, formulas used in the unit, and a hint on calculation of problems. Students were to read the information provided on the sheet in order to prepare for the CAI unit.



Since students were not familiar with the computer terminal, instructions were printed (Appendix E, p. 53) to teach students to use the terminal. The instruction sheet was presented to the student when he arrived at the computer center to take the unit. He was given time before beginning the unit to familiarize himself with the terminal. Also printed on the instruction sheet were the two problems to be worked in the CAI unit. The problems were presented on the instruction sheet so that students would not need to refer back to the textbook.

#### Generating the Program

The CAI program was presented via a typewriter terminal in the computer center. Students were required to sign up for a specific time to work at the terminal in order to assure each student an opportunity to complete the unit within a one week time period. The researcher accompanied each student to the computer center in order to give help and instruction on the use of the computer. The researcher assisted the student in using the computer terminal only; no assistance was given on solving the problems presented in the unit.

When the student was ready to begin the unit, he was told to type a code which instructed the computer to begin the presentation of the unit. The unit consisted of a step-by-step analysis of the calculation of each of the two problems. At each step the student was instructed to make a calculation or to answer a question. All items were presented in multiple choice form.

The student calculated the answer and entered the letter corresponding to the answer he had selected. If the answer was correct, the student was "encouraged" and told to proceed with the next step.

Appendix F, p. 56 is an excerpt from the lesson and illustrates this positive reinforcement. If the answer was incorrect, the student was given a hint and told to select another answer. If the student selected two wrong answers, he was given the correct answer and an explanation telling him how to work that step correctly. When both problems were completed, the computer printed instructions which told the student how to end the lesson and "logout" of the computer program.

The researcher then asked the student to complete an attitude form (Appendix A, p. 43) and the Coopersmith Self-Esteem Inventory (Appendix G, p. 59). The student was also given a sheet with answers to practice problems in the textbooks and hints on how to work some of the problems (Appendix H, p. 63). The practice problems followed each chapter in the textbook and when the course was taught in the traditional manner the instructor gave out the answers in class so that students could check their calculations. The hints were given for the problem which contained procedures for which no explanation had been given in the textbook or in the computer lesson.

The 20 point test over "Unit Open-to-Buy" was given during the class period immediately following the completion of the CAI unit. It consisted of three problems requiring the calculation of "Unit Open-to-Buy." All unit tests, including the CAI test, were constructed and scored by the instructor of the course.

#### Instruments Used in Correlation

Objective number two of this study was to correlate scores on the test over the computer-assisted instructional unit with the following:

Computer-assisted instruction (CAI) attitude scores

Mathematics pretest scores

American College Test (ACT) mathematics scores

Coopersmith Self-Esteem Inventory scores

Average scores on all other unit tests in the course

Final grades in the course

A discussion of the instruments used is presented below.

### Attitude Form

The attitude form (Appendix A, p.43) was derived from a form developed by Love (16). The form was modified to meet the needs of this study by eliminating unnecessary questions, rewording some questions, and by dividing it into two parts. Part A included six multiple choice questions designed to evaluate the content and presentation of the CAI unit. Part B included four statements to be rated on a summated rating (Likert) scale. This part was designed to measure students' attitudes toward the CAI unit by providing point values for each statement rated by the student. The point values for each statement were added to give a total score for each student. The students rated each statement according to the following choices: strongly agree, agree, neutral, disagree, and strongly disagree. A value of five was assigned to statements checked "strongly agree" while a value of one was assigned to statements checked "strongly disagree." "Agree," "neutral," and "disagree" statements received four, three, and two points respectively. Student attitudes were ranked from most to least favorable.

### Description of Mathematics Pretest

The mathematics pretest consisted of 20 different types of mathematical calculations as listed in Appendix B, p. 46. Ten different problems were written for each type of calculation. Problems for the pretest were selected from this pool of 200 items, with each test containing one problem from each of the 20 categories. The test was given at the beginning of the semester and scored by the instructor.

### American College Test (ACT)

The American College Test (ACT) is required of freshmen entering Oklahoma State University. The test is divided into four sections, mathematics, history, English, and science. For this study, only the scores on the mathematics section of the test were used. ACT scores were unavailable for students who had transferred to Oklahoma State University after attending another college; therefore ACT mathematics scores were available for only 25 of the 40 students.

### Coopersmith Self-Esteem Inventory

Self-esteem scores were correlated with CAI test scores in the study because it was felt that students with low self-esteem scores might not perform as well as others on the computer. The Coopersmith Self-Esteem Inventory (Appendix G, p. 59) determines a person's attitudes about himself, his home life, his school work and his relationship with other people. It consists of 51 statements to be rated "like me" or "unlike me." A score of one is assigned to all items that indicate high self-esteem and a zero is assigned to all items that indicate low self-esteem.

The Coopersmith Self-Esteem Inventory was chosen for two reasons: 1) it is relatively short, and 2) it determines a person's whole self-concept, not just his feelings about himself in certain situations. The test was given immediately after the student finished the CAI unit on the computer. Student scores were calculated and recorded.

#### Treatment of the Data

Scores tabulated on the attitude form, the Coopersmith Self-Esteem Inventory, and the mathematics pretest were collected and recorded for the 40 students in the study. American College Test (ACT) mathematics scores were collected for the 25 students for which these scores were available. For the purpose of correlation, 15 of the 16 unit tests given in the course were averaged and recorded for each student. The CAI test was not included so that it would not affect the average. Total points earned in the course by each student were also collected and recorded.

Scores from the CAI test were correlated with the following variables:

1. CAI attitude scores
2. Mathematics pretest scores
3. ACT mathematics scores
4. Coopersmith Self-Esteem Inventory scores
5. Averaged scores of unit tests
6. Final grades in the course

The Spearman Rank Order Coefficient of Correlation was utilized in determining whether there was a significant relationship at the .05 level between the CAI test scores and the six variables.

## CHAPTER IV

### ANALYSIS OF DATA

The overall objective of this study was to develop and evaluate a tutorial CAI unit for use in the Profitable Merchandising Analysis course. After development of the unit and utilization by students, a test was given over the CAI unit. The 20 point test was similar to tests given over each unit included in the course. Scores from the CAI test were correlated with six selected variables. Evaluation of the unit was determined by responses of students on the attitude form. Cost and time records were kept to determine total expenses incurred in developing and administering the computer program.

#### Student Attitudes and Evaluation

The attitude form (Appendix A, p. 43) was divided into two sections. Part A consisted of six multiple choice questions designed to evaluate the content and presentation of the CAI unit. Part B was designed to determine student attitudes toward CAI.

#### Evaluation of CAI Unit

Results from Part A of the attitude form indicated that most students reacted favorably toward the CAI unit. Responses to all questions on Part A of the attitude form are presented in Table I.

TABLE I  
TOTAL RESPONSES OF 40 STUDENTS ON THE CAI ATTITUDE FORM

Item	No. of Responses*	%**
1. The most desirable feature of the computer was:		
a. it didn't go too fast	9	16
b. it told you immediately if you were wrong	21	38
c. you weren't embarrassed when you made a mistake	5	9
d. it was interesting and fun to operate	17	31
e. other	4	7
2. The most undesirable feature of the computer was:		
a. you could not correct errors	6	22
b. the computer went too slow	2	7
c. the computer went too fast	2	7
d. not enough explanation was given	10	37
e. other	7	26
3. The content of the program was:		
a. adequate on all problems	33	79
b. inadequate on all problems	0	0
c. adequate on some and inadequate on others	9	21
4. The hints and remarks which were given after you gave the wrong answer:		
a. often helped you find the correct answer	40	100
b. rarely helped you find the correct answer	0	0
c. were a waste of time	0	0
5. If you had a choice as to how the course material would be presented, which would you choose?		
a. a good lecture	6	14
b. a good textbook	5	11
c. a good computer presentation	17	39
d. other	16	36

TABLE I (Continued)

Item	No. of Responses	%
6. If you had a choice, how much of this course would you like to take on the computer?		
a. 1/4	11	26
b. 1/3	4	10
c. 1/2	16	38
d. all	9	21
e. other	2	5

\* Numbers on each item may not equal the total sample number because students were allowed to answer more than once or not answer at all.

\*\*Percentages are based on total number of responses to each item.

The numbers and percentages may not equal the total sample because students were allowed to check none or several answers for each item.

Student responses indicated that the most desirable feature of the computer was immediate feedback. Students were told immediately whether their answers were correct or incorrect. Feedback was listed as the desirable feature by 38 per cent and 31 per cent commented that the computer was interesting and fun to operate. The most undesirable feature of the CAI unit was listed as not enough explanation by 37 per cent of the students while 22 per cent responded that it was difficult to correct errors.

Of the 40 students 79 per cent indicated that the content was adequate on all problem. All students indicated that the hints provided by the computer helped them find the correct answer. Given a choice of a lecture, a textbook, or a computer presentation, most



students indicated that they would choose a computer presentation. A computer presentation was preferred by 39 per cent while 14 per cent chose a lecture, 11 per cent chose a textbook, and the remaining 36 per cent chose combinations of the three methods.

Most students indicated that they preferred not to take an entire course on the computer; however, they would like to take part of a course on the computer. Only 21 per cent indicated they would prefer the entire course via computer, while 38 per cent chose half, 26 per cent chose one-fourth, 10 per cent chose one-third and five per cent preferred none.

In response to an open ended question asking for suggestions for improvement, three students commented that additional problems needed to be worked on the computer. Several commented that the practice problems from the textbook needed to be worked by the students on the computer. Two students wanted to see an example problem worked out completely on the computer. Four students indicated that more detailed instructions and explanations needed to be provided. Two students suggested that a self-paced course with a discussion period be used in combination with the computer method.

### Student Attitudes

Part B of the attitude form contained statements rated on a summated rating scale. The total point values obtained from these statements were used to correlate with the CAI test scores. Each student's total score on the four statements was used to indicate his attitude toward CAI. Scores of all students on the attitude form were reported in Appendix I, p.66. The mean point score on the rated

statements was 17.25. Since the highest score possible was 20, this indicated a positive attitude toward the CAI lesson.

#### Results of Correlation

The Spearman Rank Order Coefficient of Correlation was used to determine the relationship between the CAI test scores and the six other variables. The Spearman Rank Order Coefficient of Correlation was selected because of the small sample size in the study. The correlation coefficients were calculated by computer. Results obtained are presented in Table II. Three of the correlation coefficients were significant at or beyond the .05 level. A significant relationship existed at the .01 level between CAI test scores and final grades in the course. A significant relationship existed between CAI test scores and mathematics pretest scores at the .05 level.

Correlations between the CAI test and attitude scores, Self-Esteem scores, and ACT mathematics scores were not significant. Raw scores used in the computer correlation are reported in Appendix I, p. 66.

#### Cost Analysis

During the study, time and cost were constantly checked and recorded. Writing and revision of the subject matter content of the program required approximately six hours. The actual programming of the lesson required eight to nine hours at the computer terminal. The average time required for a student to complete the lesson was 26 minutes.

TABLE II  
CORRELATION OF CAI TEST SCORES WITH  
SIX SELECTED VARIABLES

Variables	Number	Coefficient of Correlation	Probability
Average of Unit Tests	40	0.553	.01
CAI Attitude Form Scores	40	-0.065	NS*
Self-Esteem Inventory Scores	40	0.007	NS*
Final Course Grades	40	0.569	.01
ACT Mathematics Scores	25	-0.046	NS*
Mathematics Pretest Scores	40	0.270	.05

\*Not significant

The total cost of computer time used in programming the lesson was \$18.65. The programming cost is a one-time outlay; therefore as the program is used over a period of semesters, this cost is reduced. The total cost of computer time used for student participation on the terminal was \$49.36. This figure was divided by the number of students to determine that the average cost per student for the lesson was approximately \$1.24.

## CHAPTER V

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The overall objective of this study was to develop and evaluate a tutorial computer-assisted instructional unit for use in Profitable Merchandising Analysis, a senior course in the Clothing, Textiles, and Merchandising Department.

Specific objectives formulated for the study were to:

1. develop a computer-assisted instructional unit over one concept in the course and a 20 point test over that unit,
2. correlate scores on the test over the computer-assisted instructional unit with the following:
  - Computer-assisted instruction (CAI) attitude scores
  - Mathematics pretest scores
  - American College Test (ACT) mathematics scores
  - Coopersmith Self-Esteem Inventory scores
  - Average scores on all other unit tests in the course
  - Final grades in the course
3. evaluate the content of the computer-assisted instructional unit and make recommendations for revision, and
4. determine cost and time used in developing and administering the computer-assisted instructional unit.

The study was limited to one subject area, "Unit Open-to-Buy" and one method of instruction, CAI.

Forty students enrolled in the Profitable Merchandising Analysis course, Spring, 1975 participated in the study. The CAI unit was developed and programmed by the researcher. Students completed the unit, an attitude form and the Coopersmith Self-Esteem Inventory and took a test over the CAI unit during a regular class period.

CAI test scores were then correlated with six variables using the Spearman Rank Order Coefficient of Correlation. A significant correlation existed at the .01 level between CAI test scores and averaged unit tests. The relationship between CAI test scores and final grades was also significant at the .01 level. Evidence pointed to the conclusion that if a student scored high on the unit tests and in the class, he would score high on the CAI test also. This indicated that students did as well with the CAI unit as when the information was presented by the instructor. The mathematics pretest scores correlated significantly at the .05 level with CAI test scores; therefore, students who scored high on the mathematics pretest, also scored high on the CAI test. Because of the small sample, however, results from this study should not be generalized to all populations. Additional studies should be conducted with larger samples.

Results of Part B of the attitude form indicated a high percentage of students reacted favorably toward the CAI unit. An average score of 17.25 out of a possible 20 supported this statement. Suggestions from the students indicated that they would like to have additional problems worked on the computer. Other recommendations were that more detailed descriptions on instructions and explanations were needed. Recommended revisions for the CAI unit, including revisions for the computer program, are presented in Appendix J, p.69.

Analysis of the time and cost revealed that writing and programming the lesson involved approximately 14-15 hours of work. The average time required for a student to complete the unit was 26 minutes. Cost of programming the lesson was \$18.65 while the average amount required for a student to use the unit was approximately \$1.24. With repeated uses the cost and time of writing and programming would be reduced.

#### Recommendations for Further Study

The following recommendations are suggested for further study.

1. An experiment comparing CAI with another method of teaching (such as lecture) could be conducted using an experimental group and a control group. Each group should contain a large number of participants. The purpose should be to determine whether there is a difference in student accomplishment with the two methods of teaching.
2. The feasibility of teaching Profitable Merchandising Analysis by various methods should be investigated. One method might be an independent study class using CAI, with an occasional discussion period.
3. Further study of the cost and time expense of CAI should be conducted and compared with actual costs of traditional types of instruction.
4. The CAI approach should be used in other courses to determine feasibility of technique with various types of subject matter.
5. The study should be replicated using a larger sample.

A SELECTED BIBLIOGRAPHY

- (1) Anderson, Ernest G. "Computer-Assisted Instruction: State of Art." Technology in Education: Challenge and Change. Robert J. Goff and Fred John Pula, eds. Worthington, Ohio: Charles A. Jones Publishing Co., 1972, pp. 212-216.
- (2) Atkinson, R. C. and M. A. Wilson. "Computer-Assisted Instruction." Science, CLXII (October, 1968), pp. 73-77.
- (3) Bell, Frederick H. "Why is Computer Related Learning so Successful?" Educational Technology, XIV (December, 1974), pp. 15-18.
- (4) Brudner, H. J. "Computer-Managed Instruction." Science, CLXII (November, 1968), pp. 970-976.
- (5) Cooley, William W. and Robert Glaser. "The Computer and Individualized Instruction." Science, CLXVI (October, 1969), pp. 574-582.
- (6) Crowley, Thomas H. Understanding Computers. New York: McGraw-Hill Book Co., 1967.
- (7) Dick, Walter and Raymond Latta. "Comparative Effects of Ability and Presentation Mode in Computer-Assisted Instruction and Programmed Instruction." Computerized Educational Technology, I (1972), pp. 13-30.
- (8) Dunn, Alex. "Individualization - A Reality with Computer Support." Audiovisual Instruction, XIX (May, 1974), pp. 30-34.
- (9) Hall, Keith A. "Inservice Mathematics Education for Elementary School Teachers via Computer-Assisted Instruction." Educational Technology, XIV (April, 1974), pp. 59-61.
- (10) Hayman, John L. and Cynthia Mable. "Computer-Managed Instruction at a College of Education." Educational Technology, XIV (September, 1974), pp. 60-63.
- (11) Johnson, Clemens. Educational Uses of the Computer: An Introduction. Chicago: Rand McNally and Co., 1971.
- (12) Kneider, Albert P. Mathematics of Merchandising. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971.

- (13) Lamon, William. "The Computer: An Instructional Aid in the Secondary Mathematics Classroom." Journal of Educational Data Processing, VIII, 6 (1971), p. 11.
- (14) Landis, H. John. "A Validity Study of the Self-Esteem Inventory." Paper presented at American Educational Research Association, Chicago, Illinois, April, 1972.
- (15) Longo, Alexander A. and Frank E. Guinti. "The Tutorial Mode of CAI at the U. S. Army Signal Center and School." Educational Technology, XIII (October, 1973), pp. 57-58.
- (16) Love, William P. "Individual Versus Paired Learning of an Abstract Algebra Presented by Computer-Assisted Instruction." (Unpub. doctoral dissertation, Florida State University, 1970.)
- (17) Margolin, Joseph B. and Marion Mirsch. Computers in the Classroom. New York: Spartan Books, 1970.
- + (18) Mitchell, P. David. "Can Computer Simulation Improve the Effectiveness of College Teaching." Educational Technology, XIII (December, 1973), pp. 14-17.
- (19) Oettinger, Anthony. Run, Computer, Run: The Mythology of Educational Innovation. Cambridge, Massachusetts: Harvard University Press, 1969.
- + (20) Reed, Fay Carol, Paul Y. Ertel and Marie E. Collart. "A Model for the Development of Computer-Assisted Instruction Programs." Educational Technology, XIV (March, 1974), pp. 12-20.
- (21) Schoen, Harold T. "CAI Development and Good Educational Practice." Educational Technology, XIV (April, 1974), pp. 54-56.
- (22) Scrivens, Paul. "Indicon Project." Computerized Educational Technology, I (1972), pp. 135-192.
- (23) Solomon, Lanny. "CAI: A Study of Efficiency and Effectiveness." Educational Technology, XIV (October, 1974), pp. 39-41.
- (24) Spatz, Christopher and James O. Johnston. "Internal Consistency of the Coopersmith Self-Esteem Inventory." Educational and Psychological Measurement, XXXIII (1973), pp. 875-876.
- + (25) Suppes, Patrick and Mona Morningstar. "Computer-Assisted Instruction." Science, CLXVI (October, 1969), pp. 343-350.
- (26) Tennyson, Robert D. "Applications of Computers in Education." Audiovisual Instruction, XIX (May, 1974), pp. 49-52.



- (27) Watson, Paul G. Using the Computer in Education. Englewood Cliffs, New Jersey: Educational Technology Publications, 1972.
- (28) Weiner, Max, Samuel Malkin, Carl Helm, and John Howell. "An Evaluation of 1968-69 New York City CAI Project in Elementary Arithmetic." Presented at American Educational Research Association, Minneapolis, Minnesota, February, 1970.
- (29) Young, Kenneth C. "Computer-Managed Courses in the Management Curriculum." Proceedings of the Conference on Computers in the Undergraduate Curricula. Pullman Washington: Computer Science Department with Support by the National Science Foundation, Washington State University, 1974.
- (30) Young, Kenneth C. "Using a Computer to Help Implement the Keller Method of Instruction." Educational Technology, XIV (October, 1974), pp. 53-55.

APPENDIX A

ATTITUDE QUESTIONNAIRE CONCERNING  
COMPUTER LESSON

Please complete the following statements by circling your choice of answers.

1. The most desirable feature of the computer was:
  - a. it didn't go too fast
  - b. it told you immediately if you were wrong
  - c. you weren't embarrassed when you made a mistake
  - d. it was interesting and fun to work with
  - e. other \_\_\_\_\_
  
2. The most undesirable feature of the computer was:
  - a. you could not correct errors
  - b. the computer went too slow
  - c. the computer went too fast
  - d. not enough explanation was given
  - e. other \_\_\_\_\_
  
3. The content of the program was:
  - a. adequate on all problems
  - b. inadequate on all problems
  - c. adequate on some and inadequate on others
  
4. The hints and remarks which were given after you gave a wrong answer:
  - a. often helped you find the correct answer
  - b. rarely helped you find the correct answer
  - c. were a waste of time
  
5. If you had a choice as to how the course material would be presented, which would you choose:
  - a. a good lecture
  - b. a good textbook
  - c. a good computer presentation
  - d. other \_\_\_\_\_
  
6. If you had a choice, how much of this course would you like to take on the computer?
  - a. 1/4
  - b. 1/3
  - c. 1/2
  - d. all
  - e. none

Please check the box which indicates how you feel about statements 1 - 4.

Strongly Agree: Agree completely with the statement.

Agree: Agree somewhat with the statement.

Neutral: Can neither agree or disagree with the statement.

Disagree: Disagree somewhat with the statement.

Strongly Disagree: Disagree completely with the statement.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I personally enjoyed using the computer terminal.					
2. While taking the lesson, I felt very relaxed and at ease.					
3. I felt the lesson was a valuable aid to my learning.					
4. My attitude toward computer-assisted instruction is completely favorable.					

Do you have any suggestions for improving this computer program?  
Write your comments below.

APPENDIX B

OUTLINE OF MATHEMATICS PRETEST

## Problem Number

1. Addition of whole numbers
2. Subtraction of whole numbers
3. Multiplication of whole numbers
4. Division of whole numbers
  
5. Addition of decimals
6. Subtraction of decimals
7. Multiplication of decimals
8. Division of decimals
  
9. Addition of fractions
10. Subtraction of fractions
11. Multiplication of fractions
12. Division of fractions
  
13. Change fractions to percentages
14. Change percentages to fractions
  
- 15 - 19. Different types of problems dealing with percentages
  
20. Story problem

APPENDIX C  
COURSE CONTENT FOR PROFITABLE MERCHANDISING  
ANALYSIS - SPRING, 1975

TEXT: Mathematics of Merchandising by Albert F. Kneider  
Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

OVERALL OBJECTIVES:

1. To recognize and be able to define terms used in merchandising.
2. To develop skill in doing mathematical calculations.
3. To identify the elements that affect profit and develop an awareness of the relationship among those elements.
4. To acquire minimum skill in analyzing and interpreting figures.

BASIC CONCEPTS COVERED:

Basic Mathematics Pretest

Terms of Purchase

Individual Markup

Cumulative Markup

Average Markup

Initial Markup

Maintained Markup and Markdown

Gross Margin

Stock Turnover

Sales Planning

Stock Planning

Planning Purchases

Dollar Open-to-Buy

Unit Open-to-Buy

Planning Model Stocks

Retail Method of Inventory

Retailer's Operating Statement



APPENDIX D

GENERAL INFORMATION SHEET ON "UNIT OPEN-TO-BUY"

1. Before going to the computer center, read pp. 232-236 in the textbook.
2. You will not need your book, but DO BRING THIS SHEET to the lesson.
3. Go to 115-B Math Science. This room is located on the WEST side of the hall. (There are two 115-Bs. Go to the one in the hall nearest Home Economics West.)
4. A typed schedule will be posted on the bulletin board outside the CTM office. Check it and recheck it to make sure you know your correct appointment time.
5. Be prompt! If you miss your appointment, there may not be enough time to reschedule it. If you must miss an appointment, contact Terrie Shell, ext. 466 or 377-9101, or leave a note in her box in the CTM office.
6. Terrie will be at the computer center to assist you.

Use the following key when referring to problems concerning unit open-to-buy:

MIN = Minimum stock

S = Weekly rate of sale

MAX = Maximum stock

OH = Stock on hand

R = Reserve

OO = Stock on order

DP = Delivery Period

OTB = Open-to-buy

RP = Reorder Period

TO = Turnover

You will use the following formulas. When the computer unit asks you which formula to use, type in the letter representing the correct formula.

A.  $\text{MIN (weeks supply)} = R + DP$

B.  $\text{MIN (units)} = (R + DP) \times S$  (when R is given in weeks)

C.  $\text{MIN (units)} = R + (DP \times S)$  when R is given in units

D.  $\text{MAX (weeks supply)} = R + DP + RP$

E.  $\text{MAX (units)} = (R + DP + RP) \times S$  (when R is given in weeks)

F.  $\text{MAX (units)} = R + (DP + RP) \times S$  (when R is given in units)

G.  $\text{OTB (units)} = \text{MAX} - (\text{OH} + \text{OO})$

H. Average Stock (weeks) =  $R + 1/2 RP$

I. Average Stock (units) =  $R = 1/2 (RP \times S)$

J. Stock Turnover =  $\frac{\text{Sales}}{\text{Average Stock}}$

NOTE: Calculation of MAX, MIN, and Average Stock may be done in terms of weeks or units. Your selection of a formula to use will depend on whether the answer is desired in weeks supply or in units and on whether the reserve is given in weeks supply or units.

Although the reserve figure may be given in terms of either weeks or units, RP and DP are always given in weeks. When reserve is given in weeks supply, it may be added to RP and DP (see Formulas D & E). However, when R is given in units, it must be treated separately from RP and DP (see Formulas C & F).

APPENDIX E

COMPUTER INSTRUCTIONS

Read all of the following instructions on how to operate the computer before proceeding.

1. Type answers as you would on a regular typewriter; but pay attention because some of the figures (ex. \$) are in a different place than on a regular typewriter.
2. After you type each answer, hit the "return" key. This tells the computer that you are finished with your response.
3. When you are asked a question the computer will go to the next line and type an underscore \_. This lets you know that it is waiting for your response. Do not type in your response until the computer types the underscore.
4. Most problems in the lesson are multiple choice. Each time you type in a letter as the answer, it must be a capital letter. Otherwise, the computer will consider it an incorrect answer. Also, should you have to type in an answer in dollars or per cent, you will need to use the \$ sign and the % sign.
5. If you type the wrong answer by mistake, backspace over the entire answer. This erases it and allows you to type in the correct answer.
6. Exercise caution in using the figures 1, I, and l (L). If you need the number one, type in the numeral 1; otherwise your answer will be incorrect. Also, pay attention to the small l and the Capital L. On the computer terminal, they look very similar. Be sure you are typing the one you want.

Problem Four:

The rate of sale of a \$4 tie is estimated at 50 per week by Ed George, the buyer. Mr. George wishes to maintain a reserve of six dozen ties and plans to reorder stock every two weeks. On the basis of past experience, Mr. George estimates that delivery will take two weeks after the order is placed. If there are 100 ties in stock and another 36 on order, calculate the unit open-to-buy and the planned annual stock turnover for the \$4 tie.

**Problem Five:**

Ronald Kimaid, a buyer of men's furnishings, has estimated that a four-week supply of a \$2 undershirt is to be kept on hand and on order as his maximum stock. During the first three weeks of the season, he has discovered that 180 shirts have been sold and that he has 200 on hand and another four dozen on order. As Mr. Kimaid's assistant you are required to determine the unit open-to-buy for the fourth week of \$2 undershirts based on the following weekly distribution of sales.

Weeks of Season	CUMULATIVE Weekly Distribution of Seasons Sales
1	4%
2	7%
3	12%
4	16%
5	22%
6	27%
7	32%
8	38%
9	42%

APPENDIX F

EXERPT FROM COMPUTER PROGRAM

Problem One (Student response is italicized)

Good afternoon. Type in your name.

*Terrie*

Hi, Terrie

Read Problem Number Four from Chapter 13.

In order to work this problem, first obtain the OTB figure. What is the first step in obtaining OTB?

- A. Find the Maximum stock in units.
- B. Find the average stock in units.
- C. Subtract stock on hand from Maximum stock.
- D. Multiply \$4 by 50 per week.

Type the correct letter on the following line.

*A*

Right! Maximum stock must be obtained first.

Which formula do you use to find MAX in this problem? Use your list of formulas.

*F*

Right! Formula F is the appropriate formula.

Work the problem using the given figures and type in the letter representing the correct MAX.

- A. 76 units      B. 206 units      C. 3800 units      D. 272 units

*B*

OOPS!. That is not right. First add DP to RP.  $2 + 2 = 4$ . Then multiply by weekly rate of sale.  $4 \times 50 = 200$ . Then add reserve to the resulting figure.  $72 + 200 = 272$

Maximum stock is 272. Now OTB can be obtained. Type in the letter of the formula to use.

*I*

No, the correct formula for this problem is G.





APPENDIX G

COOPERSMITH SELF-ESTEEM INVENTORY

DIRECTIONS: Please mark each statement in the following way: If the statement describes how you usually feel, place an X in the parenthesis next to the statement "Like Me". If the statement does not describe how you usually feel, place an X in the parenthesis next to the statement "Unlike Me". There are no right or wrong answers.

	Like Me	Unlike Me
EXAMPLE: I'm a hard worker . . . . .	( )	( )
1. I spend a lot of time daydreaming . . . . .	( )	( )
2. I'm pretty sure of myself . . . . .	( )	( )
3. I often wish I were someone else . . . . .	( )	( )
4. Every time I plan to do something (make a plan) something goes wrong . . . . .	( )	( )
5. I'm easy to like . . . . .	( )	( )
6. My parents and I have a lot of fun together . . . . .	( )	( )
7. I wish I were younger . . . . .	( )	( )
8. There are lots of things about myself I'd change if I could . . . . .	( )	( )
9. I can make up my mind without too much trouble . . . . .	( )	( )
10. I'm a lot of fun to be with . . . . .	( )	( )
11. I get upset easily at home . . . . .	( )	( )
12. Luck decides most things that happen to me .	( )	( )
13. Someone always has to tell me what to do . .	( )	( )
14. It takes me a long time to get used to anything new . . . . .	( )	( )
15. I'm often sorry for the things I do . . . . .	( )	( )
16. I'm popular with people my own age . . . . .	( )	( )
17. My parents usually consider my feelings . .	( )	( )
18. I don't stick up for myself very much . . .	( )	( )
19. I can usually take care of myself . . . . .	( )	( )

	Like Me	Unlike Me
20. I'm pretty happy . . . . .	( )	( )
21. If I work hard, I can be what I want to be.	( )	( )
22. My parents expect too much of me . . . . .	( )	( )
23. I would rather associate with people younger than I . . . . .	( )	( )
24. I understand myself . . . . .	( )	( )
25. It's pretty tough to be me . . . . .	( )	( )
26. Things are all mixed up in my life . . . . .	( )	( )
27. If I stick to something long enough, I can make it work . . . . .	( )	( )
28. No one pays much attention to me at home .	( )	( )
29. If I work hard, I can get a good job . . .	( )	( )
30. I can make up my mind and stick to it . .	( )	( )
31. I have a low opinion of myself . . . . .	( )	( )
32. I don't like to be with other people . . .	( )	( )
33. I often feel ashamed of myself . . . . .	( )	( )
34. I'm not as nice looking as most people . .	( )	( )
35. If I have something to say, I usually say it . . . . .	( )	( )
36. People pick on me very often . . . . .	( )	( )
37. My parents understand me . . . . .	( )	( )
38. There isn't much of a chance for a person like me to succeed in life . . . . .	( )	( )
39. I get upset easily when I'm reprimanded . .	( )	( )
40. I don't care what happens to me . . . . .	( )	( )
41. Most people are better liked than I am . .	( )	( )
42. I usually feel as though my parents are pushing me . . . . .	( )	( )

	Like Me	Unlike Me
43. If I work at something long enough, I will succeed . . . . .	( )	( )
44. I find it very hard to talk in front of the class . . . . .	( )	( )
45. I'm proud of my school work . . . . .	( )	( )
46. I'm doing the best work I can . . . . .	( )	( )
47. I like to be called on in class . . . . .	( )	( )
48. I wish I could do much better in school .	( )	( )
49. I often feel upset in school . . . . .	( )	( )
50. My professor(s) make(s) me feel I'm not good enough . . . . .	( )	( )
51. I often get discouraged in school . . . . .	( )	( )

APPENDIX H

HINTS FOR WORKING SUMMARY PROBLEMS

On problems which give CUMULATIVE Weekly Distribution of Sales, you must remember to subtract the per cent of sales already sold from the per cent of sales which will have been sold by the end of the supply period. For example, look at problem 3, p. 237. In this problem, you must subtract 13 per cent from 29 per cent to get the per cent of sales for weeks 5, 6, and 7. You will encounter this on example problem 5 and on summary problems 3, 10 and 13.

In figuring average stock in units, when reserve is given in units, R should not be multiplied by weekly rate of sale.

$$\text{Ave. Stk.} = R + 1/2 (RP \times S)$$

Only RP should be multiplied by S. Problems 6 and 8 involve this type of problem.

If there is no merchandise on hand or on order, then OTB = MAX. This is encountered on problem 14. Also note on problem 14 that the problem asks for the answer in dozens.

The textbook does not give you enough information to answer problem number 10. The following information is needed in answering the problem.

Weeks of the Season	Weekly Distribution of the Seasons Sales
1	6
2	5
3	4
4	6
5	6
6	5
7	3
8	4
9	6

## ANSWERS TO THE SUMMARY PROBLEMS ON UNIT OPEN-TO-BUY

3. OTB = 216 units
6. OTB = 248 units  
TO = 18.4
8. OTB = 32 units  
TO = 19.1
10. OTB = 421 units
13. OTB = 306 items or  $25\frac{1}{2}$  dozen
14. OTB = 28 dozen  
TO = 15.6
15. OTB = 66 units  
TO = 6.93



APPENDIX I

RAW SCORES OF PARTICIPANTS

CAI = CAI test scores (20)  
 AVE = Average of all test scores (20)  
 ATT = Attitude Questionnaire scores (20)  
 SE = Coopersmith Self-Esteem scores (25)  
 FIN = Final course points (500)  
 ACT = ACT Math scores (33)  
 PRE = Math pretest scores (20)

(Possible points in parenthesis)

Student	CAI	AVE	ATT	SE	FIN	ACT	PRE
1	20	17	19	18	472	--	17
2	5	13	17	13	330	--	15
3	17	17	19	20	410	17	15
4	20	19	19	17	486	--	18
5	20	16	10	17	382	16	15
6	13	15	20	17	355	19	17
7	20	16	20	14	440	--	--
8	20	18	20	19	435	21	14
9	17	14	18	14	322	20	11
10	20	18	13	18	440	20	20
11	17	13	19	13	363	--	15
12	18	17	15	17	469	19	19
13	5	14	10	19	376	26	17
14	1	5	16	20	132	15	12
15	9	13	20	17	382	14	12
16	15	17	11	12	433	16	19
17	20	16	20	19	422	23	20
18	17	17	14	13	427	17	16
19	20	12	17	18	367	6	13
20	16	10	17	19	344	17	11
21	14	10	19	18	266	--	15
22	15	14	17	19	371	--	14
23	12	12	16	20	340	20	14
24	20	18	16	19	462	15	15
25	15	19	20	17	460	31	20

---

Student	CAI	AVE	ATT	SE	FIN	ACT	PRE
26	20	19	13	18	465	00	17
27	20	10	18	16	264	--	13
28	15	14	20	17	384	13	18
29	10	11	20	18	291	20	14
30	17	15	20	16	446	--	19
31	20	17	15	20	450	29	19
32	20	18	20	16	440	--	16
33	20	19	10	18	491	--	19
34	20	18	17	20	490	--	20
35	20	15	20	15	349	14	14
36	17	14	20	17	341	--	17
37	20	18	18	19	480	23	20
38	19	17	18	11	456	--	19
39	16	19	20	18	458	27	--
40	20	18	19	15	464	--	20

---

APPENDIX J

RECOMMENDATIONS FOR REVISION OF PROGRAM

After reviewing the program and handouts, the following recommendations have been suggested.

Because of the lack of knowledge about how to work mathematical equations, information on mathematics problems containing a parenthesis should be included on the general information sheet (Appendix D, p. 50) given to students before the lesson. The following paragraph could be used for this purpose.

Students should remember from basic mathematics knowledge that a parenthesis dictates the order in which the problem is to be calculated.

In the following problem, the addition inside the parenthesis should be worked first.

$$72 + (2 + 2) \times 50$$

$$72 + (4) \times 50$$

When the calculation in the parenthesis is completed, the multiplication should be performed.

$$72 + (4 \times 50)$$

Then the addition outside the parenthesis can be performed.

$$72 + 200 = 272$$

Calculations inside the parenthesis should be performed first; then multiplication or division outside the parenthesis should be performed. Subtraction or addition outside the parenthesis should be performed last.

Some students suggested that the formulas given on the general information sheet be presented on the computer at the beginning of the computer unit. However, when the student neared the end of the lesson, he could have problems maneuvering the computer print-out pages. Therefore, this suggestion might not be as good as suggested by the students. Cost may prohibit this implementation of the recommendation also.

The following recommendations are suggested for revisions of the "Unit Open-to-Buy" computer program. The recommendations are written in the exact form needed for programming the computer. Line numbers for each statement are included so that a programmer could enter these statements as they are and revise the existing program. All changes and additions are based on suggestions of students for more detailed explanations and instructions.

160: ? 'and type in another letter corresponding to your answer.'

221: ? 'Type in a letter which matches your letter.'

280: ? 'The figure \$4 is not needed in this problem. Type in a different letter.'

360: ? 'Which formula do you use to find MAX in this problem?  
Type in the correct letter from your list of formulas.'

431: ? 'You should remember that the parenthesis in the formula affects the calculation of the problem.'

490: ? 'You did not add DP and RP and multiply by rate of sale before adding to R. Type in another letter.'

550: ? 'You used 6 dozen instead of multiplying 6 x 12 to obtain the number of individual items. Type in another letter.'

610: ? 'You used Formula E. Formula E requires that you multiply R by weekly rate of sale. In this case, it is not necessary because R is given in units. Do not multiply R by S.  
Try another letter.'

715: ? 'Remember that the parenthesis in the formula affects the calculation of the problem.'

840: ? 'This answer is not right. You added OH and OO to MAX.  
Study the formula and select another letter for your answer.'

- 1200: ? 'Using Formula I, determine the average stock. Pay attention to the parenthesis.'
- 1201: ? 'Which of the following letters represents the correct answers.'
- 1280: ? 'In order to figure annual stock turnover you must calculate average stock in units. Select another letter.'
- 1340: ? 'You used the entire RP instead of half of it. Select another letter.'
- 1410: ? 'By rate of sale. Only the RP should be multiplied by rate of sale. Select another letter.'
- 2090: ? 'Third week from the per cent for the seventh week. Select another letter.'
- 2201: ? 'Type in another letter.'
- 2655: ? 'Pay attention to the parenthesis.'
- 2720: ? 'You subtracted OO from OH when you should have added. Select another letter.'
- 2780: ? 'You added (OO + OH) to MAX instead of subtracting. Select another letter.'
- 2940: ? 'You subtracted OO from OH and then added to MAX. Select another letter.'

VITA

Teresa L. Smith Shell

Candidate for the Degree of

Master of Science

Thesis: COMPUTER-ASSISTED INSTRUCTION IN A PROFITABLE MERCHANDISING ANALYSIS CLASS

Major Field: Clothing, Textiles, and Merchandising

Biographical:

Personal Data: Born in El Dorado, Kansas, August 30, 1952, the daughter of Mr. and Mrs. William C. Smith.

Education: Graduated from Sooner High School, Bartlesville, Oklahoma, in May, 1970; received the Bachelor of Science degree from Oklahoma State University in 1974, with a major in Home Economics Education; completed requirements for the Master of Science degree at Oklahoma State University in December, 1975.

Professional Experience: Graduate Research Assistant, Clothing, Textiles, and Merchandising Department, Oklahoma State University, 1974-75.