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**A study of the effects on achievement of supplemental  
computer-aided instruction versus supplemental reading in the  
instruction of micro-economics**

Ellis, Richard Simon, Ed.D.

The University of North Carolina at Greensboro, 1987

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A Study of the Effects on Achievement of Supplemental  
Computer-Aided Instruction versus  
Supplemental Reading in  
the instruction of  
Micro-economics

by

Richard S. Ellis

A Dissertation Submitted to  
The Faculty of the Graduate School at  
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in Partial Fulfillment  
of the Requirements for the Degree of  
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Greensboro  
1987

Approved by

  
Dissertation Advisor

APPROVAL PAGE

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The purpose of this investigation was to assess the effectiveness of computer aided instruction in the achievement of students in undergraduate microeconomic classes. The procedures were to use a quasi-experimental pretest-posttest, non-equivalent control group design.

Two forms of the Test of Understanding of College Economics and a questionnaire were administered to the students in order to test three hypotheses dealing with differences in achievement among the groups based on type of instruction, keyboard familiarity, GPA, socio-economic background and teacher effects.

The analysis of data confirmed the hypotheses that there would be a significant difference between the posttest scores of the control groups and the treatment groups. The hypothesis that the CAI group would score significantly higher than the reading group was not confirmed. The chosen variables to explain the differences in achievement were not significant although GPA, family income, and number of prior economic classes displayed a trend towards significance. The trend of the data analysis appeared to confirm the beneficial effects of CAI and the theory of operant conditioning.

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## CHAPTER 1

### INTRODUCTION

Technology has been linked to learning throughout most of the history of human civilization. The ancient Mediterranean cultures used clay tablets and papyrus, later cultures used paper, pen, and books. The twentieth century has witnessed the utilization of films, records, and transparency projectors. In today's world, many learners are receiving instruction by radio, television, electronic sound and visuals stored on tape, the telephone, the computer, and the communications satellites. New approaches to learning are being stimulated by the growing availability of videodiscs, microcomputers, computer graphics, fiber optics, and lasers (Grayson, 1981). Computer networking systems have given the educator the ability to increase student-teacher interaction and the ability to manage and monitor the workstations of the students.

Shane (1982) contended that the world has gone through four distinct revolutions. The first was occasioned by the development of complex speech. The art of writing heralded the second revolution. Johann Gutenberg triggered the third revolution with his invention of the printing press. The fourth and potentially most profound revolution has been wrought by the enormous advances in telecommunications.

Seymour Pappert (1980) stated that the "computer presence" (p. 5) can contribute to mental processes. Pappert wrote that the computer presence will enable us to modify out of school learning. "The world is in the midst of a major change in society that is being driven by technology", (p.88) stated John V. Roach, president and chairman of the board of Tandy Corporation (1983).

In most countries, computers are provided primarily for secondary and university level education to teach computer science and programming, word processing, database systems, and as a tool in teaching general academic subjects (Charp, 1987). In the classroom, the microcomputer will be used as the object of instruction, the medium of instruction, and the tool for administration (Roach, 1983). A study by Ramsden (1984) of computer-aided instruction (CAI) in England, described the following types of CAI:

Instructional--in this type of CAI there is a body of material which must be put across and then tested.

Revelatory--in which the student is guided through a process of learning by discovery in which the subject matter and any underlying theories are progressively revealed as the package is worked through.

Conjectural--in which the student is in full control of the computer, can use it to test ideas and hypotheses.

In 1983, The Secretary of Education of the United States Department of Education stated the following about the importance of computers in education:

I believe strongly that computers have an important role to play in the schools... it may be that computers can also be used to reduce the labor-intensiveness of education that contributes to the continually rising costs and increased expenditure per student with each passing year. (Bell, 1983, p.14)

Educators' effectiveness hopefully will be enhanced by computers to give more time for individual attention, support, challenge, and leadership. A study by Barbour (1986) found that many teachers agree that computers should be included in the curriculum. Students who are expected to function in a world run, almost literally, by computers have needs that include a study of the history and development of computers and their impact on society (Watson, 1985). The 1986 report by the National Task Force on Educational Technology to the Secretary of Education of the United States Department of Education recommended that schools use technology based education to make learning more active and interactive for each student, including pacing at a rate appropriate to each student. The Task Force concluded that the greatest promise of technology is that it has the capability to manage and deliver learning geared to the needs of each student, that teachers in the classroom should become familiar with computer based technology, and that teachers should use technology for their own education.



## Background of the Problem

### 1. The History of Computers

The history of computers began when the electronic digital computer first appeared in the middle 1940's. Then, it was a specialized calculating tool of mathematicians and scientists. Today, it has helped to solve information problems in almost every area of human activity.

According to the International Business Machine Corporation (1974), the forerunners of today's electronic digital computers included:

The Abacus--The first digital calculator which is really a mechanized form of pebble counting.

Pascal's Arithmetic Machine--Blaise Pascal, a French mathematician, philosopher and writer--devised a calculating machine in 1642. This machine demonstrated the practicability of mechanized calculation.

Leibniz' Calculating Machine--He wanted to mechanize the calculation of trigonometric and astronomical tables and free scientists for more fruitful work.

Punched Card Looms--Weaving looms in France were the first machine to be controlled automatically from coded information punched into paper cards. First proposed in the first half of the eighteenth century, the idea of using holes punched in paper to control the operation of a loom was perfected by Joseph Marie Jacquard in 1804.

Babbage's Calculating Engines--over a century ago, Charles Babbage designed a machine based on the same basic principles as today's electronic computers.

Punch Card Counting--Dr. Herman Hollerith was the first person to use electrical tabulating equipment to analyze statistical data. Hollerith's first electrical tabulator used a clock-like counting device. Cards were sorted semi-automatically.

When a card was counted in the tabulator, a cover on a preselected compartment in a separate sorter box opened automatically.

Mark I: The First Large Scale Automatic Digital Calculator--In 1937, a Harvard University Ph.D. physics candidate, Howard H. Aiken, outlined plans for a machine that could be made to solve differential equations automatically. Mark I was a 5-ton machine, consisting of a complex of 78 devices linked by 500 miles of wiring.

ENIAC--The need for ever faster computations kept mounting. This pursuit of speed led to the first electronic computer, ENIAC (Electronic Numerical Integrator and Calculator). ENIAC was completed in 1946. The need for mechanically moving parts were eliminated; Instead, electronic flip-flop circuits were adapted and electronic pulses were used to flip vacuum tubes.

## 2. The Four Generations: 1945-1987

The First Generation of computers, with their vacuum tubes, consumed massive amounts of space, electricity, and money for maintenance. By 1959 transistor technology had replaced the vacuum tubes. These transistor-based computers, developed in the late fifties and early sixties, were known as second-generation systems.

By 1964, integrated circuits had replaced much of the second-generation transistor technology in computers. A chip could be made to do a wide range of things to electrical current based upon what impurities were added at what places. With the aid of this new semiconductor technology and supporting manufacturing procedures using photographic reduction procedures, hundreds of transistor-like units could now fit on chip

the size of a match head. Computers heavily dependent on this integrated circuit technology were known as third-generation computers (Hofmeister, 1984).

The fourth generation began in the 1970's with the advent of large-scale integration (LSI). The first LSI chips contained thousands of transistors; later, it became possible to place first tens and then hundreds of thousands of transistors on a single chip.

The fifth-generation is a project that is being launched to develop the next generation of computers. It is anticipated that they will be used in the 1990's. A key to fifth-generation computers is expected to be parallel processing (Grahm, 1986).

### 3. The History of Teaching Machines

The initial uses of technology in education included the areas of teaching machines and programmed instruction. Skinner (1968) wrote that the development of teaching machines began in the 1920's when Sidney L. Pressey designed several machines for the automatic testing of intelligence and information. The theoretical background of Pressey's machines stemmed from operant conditioning concepts of the importance of immediate feedback in education and from the development of a system in which a student could move at his own pace. To Skinner, the application of operant conditioning to education is simple and direct:

Teaching is the arrangement of contingencies of reinforcement under which students learn. They

learn without teaching in their natural environments, but teachers arrange special contingencies which expedite learning, hastening the appearance of behavior which would otherwise be acquired slowly or making sure of the appearance of behavior which might otherwise never occur. A teaching machine is simply any device which arranges contingencies of reinforcement. There are as many different kinds of teaching machines as there are different kinds of contingencies (Skinner, 1968, p. 65).

Programmed instruction made its first appearance in the laboratory in the form of programmed contingencies of reinforcement (Skinner, 1968). Programmed instruction that used the computer, evolved from the instructional design concepts originally used to develop programmed instructional products. The products were usually programmed textbooks or the instructional material in teaching machines. Industry and the military have frequently used programmed instructional methods for training and for educational purposes. Most computer aided programmed instruction products are usually classified as drill and practice, or tutorial programs (Hofmeister, 1984). The small computer is the ideal hardware for programmed instruction (Skinner, 1986). Skinner stated that "It is not functioning as a computer, of course; it is teaching. It should be called a teaching machine." (1986, p. 110)

#### 4. Computers in Education

The earliest work in applying computers to education began in the late 1950's with activities at IBM to develop the Coursewriter Language and at the University of Illinois where initial work was done on the PLATO system (Grayson, 1981). Grayson estimated that in 1980, the total expenditures for education exceeded \$1.2 billion. The number of personal computers for instructional use in public elementary and secondary schools has risen dramatically from 31,000 in 1981 to 630,000 in 1984 and is expected to double in each of the next five years, according to the National Center for Education Statistics (1986). Electronic Education (1985) reported that several colleges require students to purchase personal computers. According to Talmis, Inc. (1986) more than 1.3 million microcomputers are used in schools, and that number could grow by 400,000 this year. Barbour (1986) reported that college faculty members do not voice active opposition to the concept of using technology in instruction. Indeed, 86 percent said that computers increased their effectiveness as teachers, and 70 percent reported that computers were useful tools for course management.

A curriculum theory that applies to the process of learning that takes place with the utilization of computer-assisted instruction was developed by Rushby (1984). He stated:

In a simplistic view of the learning process, the pupil acquires knowledge by receiving information from his surroundings and organizing it so that he can retrieve specific items, make generalizations and extrapolations. The speed and perhaps the quality of some learning may be improved if the pupil works with structured learning materials...the computer can be seen as the mediator between the learner and his learning environment. (Rushby, 1984, pp. 25-26)

The following taxonomy of the types of computer assisted instruction was developed by the American Federation of Information Processing Societies in 1980.

Skills practice for example arithmetic manipulations.

Diagnostic testing which attempts to diagnose gaps in knowledge by presentation of appropriate test items or item sequences.

Tutorial instruction by which new material is presented and its understanding tested.

Simulation by which simulated situations are presented to the student.

Modeling by which students build and test models based on data presented to them.

Problem solving in mathematics, science, or engineering.

Artistic creation of graphic arts, music, and written composition.

Materials production of graphical, animated and written materials. (pp. 348-349)

The drill and practice type of computer assisted instruction usually presents to the student elements of skills practice and tutorial instruction.

The need for the curriculum integration of computers in the classroom was addressed by Brody (1986). Brody stated that one of the most frequent strategies employed to bring microcomputers to the classroom has been to develop special courses in "computer literacy" (p. 32). "The computer literacy approach increases the likelihood of students failing to

appreciate how computers can be used in all walks of life" (Brody, 1986, p. 32). Brody called for the integration of computers into the curriculum by developing and applying computer skills in a variety of academic areas.

The effective utilization of computers in education was studied by Gleason (1985). His study of Wisconsin schools found that the school boards and administrators should provide the policy direction for implementing computers and that extensive teacher in-service training should be planned and implemented. Bingham (1986), reported that in June 1985, North Carolina passed legislation establishing standards for the computer competency of public school teachers. The law set three levels of computer skills. The first level of training was for teachers who minimally used microcomputers. The second level enabled teachers to incorporate computers into their instructional planning. Level three developed extensive knowledge and skill in computer technology.

The role that the faculty played in the adoption of computers was researched by Bowman (1986). He suggested a strategy for creating a context for faculty dialog, consensus, and curricular planning in instructional computing. The design of a full-day, released-time, faculty retreat in which the faculty approached decision making through consensus-building structures and strategies consisted of the following:

- A. The faculty was assigned to small brainstorming groups. Each member has a discussion sheet that outlines the discussion issues.
- B. Spokespersons from each group highlighted their response to the computer literacy issues.
- C. An opportunity was provided for each participant to discuss particular points of interest and concern.
- D. A final session that identified the implications of instructional computing to policy formation at both the institutional and departmental levels. (Bowman, 1986, pp. 60-62).

Another approach to the involvement of the faculty in computer education was outlined by Foucault (1986). His study stated that computer assisted instruction (CAI) has come within the reach of the average college budget, yet for many schools, in-house production of CAI materials has been a model of underachievement. Foucault outlined a team approach to authoring systems in which the faculty submitted courseware development projects. Each selected faculty member was given a two course workload to develop CAI materials. The CAI team consisted of the faculty member, media director, project activity director, programmer, and video producer. Once the lesson modules had been test-run and debugged, if necessary, they were put on-line in the microcomputer lab (Foucault, 1986). The study concluded that the institutional benefits included a new cooperative relationship between faculty and media center staff, an increase in the number who use media resources, and an enhanced willingness of the faculty to contribute to the production of original learning materials.



Although there have been numerous studies related to the use of technology in education, only a limited number have focused on the effectiveness of the microcomputer in economics instruction. Therefore, this study was designed to assess the effectiveness of drill and practice CAI by comparing the impact of supplemental CAI to the impact of supplemental reading in College Economic Classrooms.

#### Statement of the Problem

The major problem of the study is to assess the effectiveness of computer assisted instruction (CAI) in the achievement of students in undergraduate microeconomics classes. The major need for the study is due to the necessity to utilize the scarce resources of faculty time and the microcomputers in the most effective and efficient manner. Additional needs for the study are due to the growth in the amount of computer utilization in the educational environment due to the reduction in the cost of microcomputers and from the demands of industry for computer literate college graduates. A quasi-experimental pretest-posttest, non-equivalent control group design is used. The nationally normed micro-economics pre and posttests from the Test of Understanding in College Economics were administered to the students at three four-year colleges. Three hypotheses dealing with differences in achievement among the groups based on type of instruction, previous

economic courses, degree of computer literacy, keyboard familiarity, GPA, and socio-economic background are tested using the SPSSX multiple regression program.

### Purposes and Objectives

The purpose of the study is to improve the effectiveness and efficiency of teaching at four year colleges by determining the practical outcomes of the investigation of the following questions:

1. Do the students in a control group who do not receive any supplemental instruction perform as well on a micro-economics posttest than the students who receive either CAI supplemental instruction or the students who read supplemental material in an undergraduate economics course.
2. Do the students who receive supplemental computer-aided instruction perform better on tests than students who read supplemental material in an undergraduate micro-economics course.
3. Can the variation in the posttest scores be explained by (a) previous micro-economic courses, (b) degree of computer literacy, (c) current academic GPA, (d) socio-economic background as measured by annual family income and (e) typing ability.

### Statement of Hypotheses

Given the preceding questions, three sets of hypotheses were developed:

The first research hypothesis is:

The students who receive supplemental instruction will score higher at the .05 level of significance than the students who do not receive either CAI supplemental instruction or the students who do not read supplemental material in an undergraduate micro-economics course.

The corresponding null hypothesis is:

The mean of the posttest scores of the control group will equal the mean of the posttest scores of the students who receive CAI supplemental instruction, and the mean of the posttest scores of the control group will equal the mean of the posttest scores of the students who read supplemental material in an undergraduate micro-economics course.

The second research hypothesis is:

The students who receive CAI will score higher at the .05 level of significance on the micro-economics posttest than the students who read the supplemental material.

The corresponding null hypothesis is:

The mean of the posttest scores of the students who receive CAI will equal the mean of the posttest scores of the students who read the supplemental material.

The third research hypothesis is:

The variation in posttest scores will be explained at the .05 level of significance by prior economic courses, degree of computer literacy, large family incomes and high GPA, and prior typing courses.

The corresponding null hypothesis is:

Neither prior economic courses, degree of computer literacy, family incomes, GPA, nor typing ability will affect the variation of posttest scores.

#### Significance of the Study

This study was an attempt to organize data to extend the knowledge base on the effectiveness of computer aided instruction. The findings of the study will prove useful to business instructors and professors in their teaching assignments, to departmental deans for their analysis of facilities implementation, and to the senior management of four-year colleges for their

modular parameters planning, because these individuals can use the study as a tool in their decision making process. The study may have been useful to the participating students by improving their study habits and their academic performance in the microeconomics course due to the supplemental instruction that each student received.

#### Scope and Limitations of the Study

Several limitations of the study were acknowledged. This study was limited to the micro-economic students at three small four-year colleges, consequently generalizations about the study were restricted to populations similar to that from which the sample was selected.

A second limitation was the fact that only one unit of instruction, that of micro-economics, was selected. The methods of supplemental instruction were limited to computer aided instruction and reading. The information that could be presented was limited in that only one method rather than a combination of methods were used. Generalizations regarding the effectiveness of computer aided instruction cannot be made with regard to other subject matter areas nor can one generalize about the usefulness of computers in combination with other teaching methods.

The literature reviewed for this study included only that which was published, and research studies

conducted, between 1968 and 1987.

Time also was a limiting factor, since the data was collected during the Spring semester of 1987 and student populations change over time.

#### Definition of Terms

The following terms have been defined in an operational manner that explicitly states the manner in which the term is utilized:

Centralized Computing is the processing of all data involved with a given activity at a given location and usually in one building housing the configuration (Sippi, 1972, p. 131).

Computer anxiety refers to the fear expressed by persons unfamiliar with computers, sometimes called computerphobia. (Faircloth, 1984)

Computer assisted instruction and computer aided instruction (CAI) refers to activities such as drill and practice, tutoring, simulations and gaming, inquiry and dialogue, information retrieval, problem solving, and demonstration (Dede, 1983; Grayson, 1981).

Computer based instruction includes the two general categories of direct instruction and instructional management (Faircloth, 1984).

Computer managed instruction encompasses instructional support functions such as testing, diagnosing, recordkeeping, scheduling, monitoring, and time and resource management (Grayson, 1981).

Decentralized Computing is the housing of data by individual subdivisions of an organization or at each geographical location of the parts of an organization. (Sippi, 1972 p. 131).

Hardware consists of the computer and its peripherals such as printer, monitor, cables, modem and external disk drive.

Individualized learning defines the learning situation in which the student works alone and controls the pace of the the pace of the learning (Faircloth, 1984).

Network-- a network of microcomputers gives each user a stand-alone computer and also a system in which that computer can be used as a terminal to connect to a central computer and/or other microcomputers and peripheral devices (Feldman, 1986, p. 4).

PILOT is an authoring language designed for instructors to write computer assisted instructional material for students and to evaluate the response of the students.

Program refers to a "sequence of statements in some programming language which directs the computer to perform a given task" (Brooks & Lyon, 1972, p. 45).

Sequence in programmed instruction refers to the segmentation of subject matter in a logical order so that the student is prepared for each segment when he reaches it. (Skinner, 1968, p. 221).

Software refers to computer programs.

User friendliness refers to the ease with which a computer a computer can be manipulated. A user-friendly program is one that requires little time to learn, offers on-screen prompts, protects the user from making disastrous mistakes, or refers to the user by name (Salisbury, 1971).

#### Organization of the Study

This study is divided into five chapters. This chapter has presented an introduction to and statement of the problem. The significance of the study was explained, limitations were cited, and terms were defined.

The second chapter presents a summary of research and literature grouped into three categories: the conceptual framework of collegiate computer aided instruction, the implementation of computer aided instruction in the college business departments, and the implementation of computer aided instruction by the

economics components of the college business departments.

The third chapter contains a detailed explanation of the methods and procedures used to study the effects on achievement of supplemental computer aided instruction and supplemental reading in the microeconomics classes at the three four-year colleges.

The fourth chapter includes an analysis of the data which were collected for the study.

The fifth chapter contains a summary of the findings, the conclusions drawn from the findings, and the recommendations based on the conclusions.

CHAPTER II  
REVIEW OF THE LITERATURE

This review of the literature is divided into three sections: 1) the conceptual framework of computer aided instruction (CAI), 2) the review of the literature pertaining to the use of computer aided instruction in the instruction of business courses to college students, and 3) the review of the literature of the use of computer aided instruction in the instruction of economics to college students.

1. The Conceptual Framework of  
Computer-Aided Instruction

This section of the review of the literature discusses recent research about the cognitive processes of CAI, the cognitive assumptions of CAI, and the effectiveness of CAI.

The Cognitive Processes of Computer Assisted  
Instruction

Hofmeister (1984) wrote that the cognitive processes that are involved in CAI are concerned with allowing the learner to consciously control the flow of instruction and the process of the computer's capacity to adjust the flow of instruction based on the learner's responses. She found that in discussions of feedback and reinforcement, the positive interactive potential of



the computer was most obvious. In her opinion most CAI programs in the schools were developed using the sequencing and structure approaches from programmed learning.

An analysis of the cognitive processes in CAI by Montague (1982) reported these four main lines of cognitive research:

1. The role of organization in the learner's mind and the need for a model that describes the interaction between the learner's knowledge structure and the structure of the information content contained in the instructional material.
2. The area of problem solving and the differences in the approaches of novices and experts in their solutions, primarily in the level of strategic knowledge applied.
3. The role of spatial representations and imagery in learning, memory and performance. His study suggested that the vividness of stories enhanced learning.
4. The area of analogical representations showed promise for assisting educational design. He described a representation as a set of propositions about an article stated in visual terms. (pp. 4-5).

The implications for instruction from his research were that interactive computer based systems must provide the cues, the opportunities for students to respond, make and correct errors, and observe the consequences of their actions. He concluded that the characteristics of a good CAI system included both the design of the appropriate representation(s) for learning, and the inclusion of the necessary learning principles that support acquisition. (Montague, 1982).

The cognitive process of the learner in the interaction with the drill and practice computer assisted instructional programs was the major focus of

the research by Streibel (1985). He reported that the drill and practice programs were the dominant use of computers in education in 1985. The cognitive related assumptions of drill and practice programs that he researched included: that previous instruction had occurred, that regular instruction was being supplemented, and that instruction occurred in a step by step linear sequence of sub-steps. Drill and practice programs assumed that the behavior of the learner could be shaped by an external, mechanical process to guide the learner towards a pre-specified behavioral goal. He concluded that drill and practice courseware programs were designed to provide immediate corrective interventions in the learning process when continuously monitored performance measures indicated incorrect responses.

#### The Effectiveness of Computer Assisted Instruction

A meta-analysis of the effectiveness of computer based education in colleges was performed by Kulik and Kulik (1985). Their research involved 101 computer based education studies. The instructional outcome measured most often in the 101 studies was student learning, as indicated on achievement examinations given at the end of the program of instruction. The analysis showed that college level CAI has had positive effects on students. In general, Kulik and Kulik found little relationship between study findings and design features of

evaluations i.e. experimental versus quasi-experimental, settings for the evaluations, or manner and date of publication of findings. A major limitation of the meta-analysis was that most of the studies were conducted with mainframe computers prior to 1980. Computers, since 1980, have become smaller and less expensive.

The dimension of cost-effectiveness of CAI was studied by Levin and Meister (1986) and by Niemiec, Blackwell and Walberg (1986). The cost-effectiveness of CAI was defined as "the degree to which it could provide instruction more effectively than alternatives"(Levin & Meister, 1986, p.746). They evaluated CAI versus peer tutoring, adult tutoring, reducing class size, or increasing instructional time. Their conclusion was that CAI was more cost-effective than all of the methods except peer-tutoring. Niemiec et al. (1986) synthesized 29 research findings on CAI and concluded that CAI was the most cost-effective. They disagreed with the conclusions of Levin and Meister regarding peer tutoring. According to Niemiec et al. (1986), Levin and Meister overestimated the achievement gains of peer tutoring and underestimated those of CAI.

An additional factor in the effectiveness of CAI is the attitude of the teacher toward the computer as a teaching tool. A research study by Harmon (1986) found that teachers attitudes and reactions to microcomputers in the classroom were becoming more positive. His methodology involved a teacher attitude survey that was

validated by panel of experts. Reliability of the survey was substantiated with the test and retest method of evaluation. He concluded that the teachers were extremely positive that educational programs could be improved by the use of microcomputers.

Ragsdale (1982) reached a different conclusion about the effectiveness of CAI in education. He stated that:

One of the assumptions about the use of computers is similar to the "Law of the Hammer"... the statement of the law is (roughly) "if you give a hammer to a two year old, suddenly a lot of things need hammering." If you change "hammer" to "computer", "two-year old" to "educator", and "hammering" to "computing" you have a description of the effect (p. 3).

His thesis was that programmed instruction was an effective instructional system. He concluded that we must question the assumption that computers will be used in schools to do all the tasks that are best suited for computers. He wrote: "...those who hold a more optimistic view of CAI ignore the success of carefully programmed instruction" (p. 6).

Another dimension in the evaluation of computer-assisted instruction is the quality of the software. Haven (1985) reported that there were about 7,700 commercially produced instructional software products commonly used in schools in 1984. He examined the database of the American Educational Research Association and found that the software was segmented in the following manner:

Subject	Proportion of Total
Mathematics	25.7%
Science	13.5%
English/Language Arts	12.0%
Reading	9.9%
Social Studies	5.2%
Teaching About Computers	5.1%
Foreign Languages	4.5%
Fine Arts	2.5%
Business	2.1%

Source: (Haven, 1985, p5.)

In order for a software product to qualify for a "high" quality rating it had to have received good ratings for instructional design and for program design. He reported that the over-all level of software quality was barely adequate and was improving only very slowly and that although there were many agencies that evaluated software, only about a quarter of the products now on the market had been thoroughly evaluated. Additionally, Haven found that a substantial volume of new products were being designed, that there was a large body of producers, and that a respectable number of high quality products were being produced.

#### Summary of the Conceptual Framework of CAI.

This review of the literature has found that the cognitive processes of CAI are concerned with letting the learner acquire and reinforce subject matter at his or her own pace. Additionally, the cognitive assumptions of CAI include that previous instruction has taken place in a logical order. The implications of the

research into the cognitive processes of CAI revealed that interactive computer based systems must provide the opportunities for the learner to respond, make and correct errors, and observe the consequences of his or her actions. The characteristics of a good CAI system include both the design of the appropriate representations for learning and the inclusion of the necessary principles that support the acquisition of learning.

The research revealed that CAI on the collegiate level has been found to be generally effective, as indicated on achievement examinations given at the end of instruction, however, most of this research took place prior to 1980. CAI has also been found to have been cost-effective to the degree that it could provide instruction more effectively than alternatives.

Additionally, this section of the examination of the literature found that the drill and practice programs was the most common form of software and that the amount of educational software was growing rapidly. Other findings included research that concluded that teachers reactions to computers were becoming more positive.

## 2. The Use of Computer-Aided Instruction in Business Courses

This section of the review of the literature reports on the use of CAI by graduate schools of business, the implications of the literature on

educational research concerning CAI for business education, and the minimal computer literacy requirements for members of the business faculty. Additionally, this section reports the results of CAI studies in the areas of computerized applications in the discipline of accounting, the use of computers in a graduate professional business program, the use of CAI by business educators in Nebraska, and an examination of the results of classroom testing on the microcomputer.

Turner (1986) reported that the nation's 650 graduate schools of business are doing the following:

- Buying microcomputers for instruction, or recommending that students buy their own.
- Restructuring courses to incorporate the kind of computing that executives are now doing at their desks.
- Requiring students to be computer-proficient before they start their studies.
- Setting up departments of management information systems. (p. 29).

She reported that these changes are due to the profound impact that information technology has had on the nation's businesses.

The implications of CAI for business educators were researched by Dalgaard & Lewis (1985). Their analysis of the general educational research literature found that in more than 80 percent of the reviewed studies CAI raised the test scores from the 50th to the 63rd percentile. They made the following generalizations concerning the effectiveness of CAI and inferred similar results for business education:

- CAI can be effective in raising student achievement.
- CAI can reduce the average training time of students.
- Student attitudes toward the subject and ratings of the quality of instruction tend to be more favorable with CAI.
- Students tend to have a positive attitude toward computers.
- Use of CAI enhances computer literacy.
- CAI may increase labor productivity (pp. 21-22).

Business faculty utilization of microcomputing technology was studied by Rucker (1986). He advocated the integration of microcomputer technology into the business curricula. He proposed an introductory course for faculty with less than a minimal computing literacy. The topics of the proposed course included:

- A historical introduction to computing technology.
- A hands-on introduction to the operating routines in using a microcomputer.
- Hands-on experience in spreadsheet and word processing software (p. 232).

The state of CAI in the accounting discipline was researched by Bialaszewski, Koeakulah, and Bialaszewski (1986) and by Parmley and Parmley (1986). Both studies involved accounting departments from schools that are members of the American Association of Collegiate Schools of Business (AACSB). Bialaszewski et al. cited a national survey of controllers in which a majority of the respondents indicated that entry-level management accountants should possess some familiarity with computers. They also cited a survey of 2000 National Association of Accountants members. The survey found that 85% of those sampled used microcomputers



(p31). The Bialaszewski et al. (1986) study was mailed to the chairperson of accounting of all 228 AACSB schools accredited at the undergraduate level. The response rate of usable questionnaires was 135 schools or 59%. It was found that accounting students from 126 of the 135 schools had access to a microcomputing laboratory. The large majority had access to an IBM PC or compatible computer. Of the 135 respondents 117 employed Lotus 1-2-3-spreadsheets in at least one accounting course, and 85 of the respondents were exposed to at least one statistical software package (p. 33). The authors concluded that computer utilization in AACSB schools will increase.

The research by Parmley and Parmley, (1986), examined the dimension of future accounting computer curriculum. Their methodology involved sending a questionnaire to the administrators of 200 randomly selected member schools of the AACSB. The member institutions were not all accredited by the AACSB. The major parts of the questionnaire included:

- Are you using computer applications in accounting courses?
- An identification of the type of hardware being used.
- A listing of specific accounting courses and applications.
- An area that investigated the degree of satisfaction with hardware and software requirements (p. 175).

The principal conclusion of the study was that in relation to nonaccredited institutions, accredited institutions had significantly greater computer

application requirements in almost every accounting course (p. 176). The additional findings were that cost accounting, systems and auditing courses were identified as the most frequent computer applications.

King, Raghunathan and Teng (1986) prepared a report on an experiment that was conducted in evaluating the use of personal computers in a graduate professional program. The experiment, which was conducted in 1982, involved about 200 full time students in the Pittsburg Graduate School of Business Master of Business Administration (MBA) Program. The purpose of the experiment was to evaluate whether microcomputers might be as effective as mainframes in teaching the BASIC programming language to students at this level. The authors of the research report defined the performance measures of evaluation in the following manner:

- routine job performance, as indicated by student grades on a set of homework assignments;
- overall learning, as indicated by the grade on a final examination; and
- attitudinal change, as indicated by student responses to a set of attitudinal items on an instrument administered at three points during the progress of the experiment - prior to the classwork, immediately on the completion of the classwork, and four months later (King et. al., 1986, p21).

The tested null hypotheses with respect to routine performance and overall learning was that there were no differences between the microcomputer and mainframe groups with respect to either measure, nor was there a significant difference found between microcomputer and mainframe treatments with respect to routine

performance. A significant difference was found between overall learning. "Those students who used the microcomputers had a better performance than those who used the mainframe (p23). The authors reported that "there were generally significantly positive changes in many important attitudinal items on the part of both microcomputer and mainframe users" (p. 23).

The authors concluded that the results neither confirmed nor denied the clear superiority of teaching BASIC on microcomputers or mainframes. They stated "that the study confirmed that microcomputers could be used as effectively as mainframes in the instruction of BASIC" (p.23) Additional conclusions were:

- (1) that new MBA students with computer experience were significantly more positive toward computers than those without such experiences; and
- (2) that many important attitudes of both microcomputer and mainframe users were significantly improved by a combination of both study and experience but not nearly as much as by study alone. (King et al., 1986, p. 23)

In the opinion of the authors, the study illustrated the value of using both quantitative and qualitative measures when assessing the effectiveness of computer systems because "if the conclusions were based solely on quantitative data the superiority of the microcomputers would have been concluded" (p. 24). They called for the need to confirm these results elsewhere and they cited published research by Chew in 1985 and Davis in 1984 that stated that "in the real world managers prefer to use microcomputers" (p24).

The topic of classroom testing on the microcomputer was researched by Perry (1987). Her research involved the basic computing classes at Brigham Young University. The types of software that the students used were WordPerfect and Lotus 1-2-3. She stated the following characteristics of these four types of tests covering classroom content that can be administered on the microcomputer:

- objective examinations such as the true/false and multiple choice are easy to administer and can be scored rapidly and easily.

- hands-on examinations offers the advantage that the students are using hardware and software that is able to produce office acceptable copy.

- power examinations which are similar to hands-on examinations except a specified time is allowed. These had the disadvantages that only a few students could complete the work in the time allotted, and the problem of how to score the student who completed most of the problem in the time allowed but forgot to save?

- take home examinations which could be completed in the school lab or on the student's home computer. The advantage of this form was the unlimited time allotted to complete the test. The disadvantage was how could one tell if the student had done the actual work? (Perry, 1987, p. 22)

Her research indicated that: "a combination of power, objective, and take-home examinations tended to use the least amount of classroom time, allowed maximum instruction time, and adequately tested students' knowledge of the course content" (Perry, 1987, p. 23).

### Summary of the Use of CAI in Business Courses

This section of the review of the literature has found that the nation's graduate schools are rapidly incorporating CAI into their curricula. The literature suggests that CAI has had a positive impact on the performance of business students as measured on achievement tests. The findings also include that business educators on the collegiate level should have a working knowledge of the historical background of computer technology, the operating routines of a microcomputer, and hands-on experience with word-processing and spreadsheet software.

The research has revealed that in the accounting discipline, CAI has significantly greater applications in AACSB accredited schools, and that computer utilization in AACSB schools is expected to increase due to the demands of industry for computer literate managers.

The microcomputer was found to have been as effective as the mainframe in the instruction of BASIC. Additionally, the findings were that qualitative and quantitative measures should be used to assess the effectiveness of CAI.

### 3. The Use of Computer-Aided Instruction in Economics Courses

This section of the review of the literature examines several national studies of the impact of computer aided instruction (CAI) in the economic education curriculum on the collegiate level. Also reviewed are the results of two dissertations in the instruction of economics that employed the pretest-posttest methodology

This section concludes with several college studies of the implementation of CAI in economic education.

A survey of the research on teaching college economics by Siegfried and Fels (1974) examined the tests that are used for economic research, the impact that CAI has made on the cognitive achievement of economic students, and the costs of CAI in economic education. The authors described several objective tests that are used in CAI research, including an early version of the Test of Understanding in College Economics (TUCE) that is used as a research instrument in this study. The TUCE was frequently used to assess the impact on achievement of CAI. They reported that national norms for the TUCE were established using data from 50 colleges. They stated that the quality of the test is considerably higher than the tests that can be constructed by individual research workers. The reported shortcomings of the test were (1) that a

general purpose test is not likely to conform to the purposes and content of any particular course, (2) that some of the questions in this version were unsatisfactory, they stated that the TUCE is currently undergoing revision to replace unsatisfactory and outdated versions), and (3) that a multiple choice test cannot measure all of the objectives of elementary instruction. The authors reported that the availability of the TUCE has led to pre-and post-course testing, which permits the following several forms of the output measure to be specified: (1) absolute achievement-the post-test score, (2) absolute improvement-the difference between the post-test and the pre-test score, and (3) percentage improvement-absolute improvement divided by the pre-test score; and (4) gap closing measure-absolute improvement divided by the potential gain in score.

The Siegfried and Fels (1974) review of the research in computer-assisted instruction (CAI) cited research by Soper (1974) of 45 published and unpublished reports of the use of CAI in teaching economics. The cognitive influences of CAI on learning were attributed to instant feedback, quick reinforcement, novelty of CAI, and the convenience of time-sharing. The conclusion was that overall the performance of CAI in improving the understanding of economics was pessimistic. The examination of the costs of CAI revealed that CAI was more expensive than conventional pedagogical methods.

Possible reasons for the above conclusions of Siegfried and Fels were suggested by Schenk and Silva (1984). In their analysis of the scarcity of positive results of CAI in economics they stated "that an evaluation of instructional materials that used a computer as an instructional tool should focus on not just the computer but the materials and method of instruction" (p. 240). Another possibility, in their opinion, was that the computer programs were improperly used. A major evaluation problem was that the goals of economic education were broader than just increasing test scores. They cited studies by King in 1979 and by Daellenbach et al. in 1977 that found statistical evidence that exposure to a specific set of economic CAI materials had a positive effect on basic student analytical ability not displayed nor reported for other comparable material.

Another national study of computer-assisted instruction that focused on the discipline of economics was conducted in 1984 by Dalgaard, Lewis and Boyer. They reviewed the development and use of CAI in the teaching of economics, summarized from the research and instructional technology a number of generalizations concerning the effectiveness of CAI, and reported information about the costs of CAI.

Dalgaard et al. (1984) reported that the use of CAI in economics began in the late 1960's. An early review of CAI research in economics by Moncreiff (1965)



reported eight such studies. From the late 1960's to the mid-1970's there were hundreds of CAI experiments in economics, most on mainframe central computer systems. Dalgaard et al. concluded that their review of the literature since the mid-1970's revealed "very little CAI development or research in economic education and virtually no mention of CAI using the new mini-or micro-computer technology and costs (p. 311)."

Dalgaard et al. (1984) cited research in economics instruction by Soper; Siegfried and Fels; Paden and Barr; and Marlin and Ness that described the instructional effectiveness of CAI. Dalgaard et. al (1984) found that the general educational research literature concerning the instructional utilization of CAI has shown a consistent interest and involvement with CAI at all levels of instruction. The generalizations that were reached by Dalgaard et al. about the instructional effectiveness of CAI included:

- Computer-based teaching can be effective in raising student achievement.
- CAI can reduce the average training time of students by permitting and encouraging each student to move at his or her own pace.
- Student attitudes toward the subject being learned and student ratings of the quality of instruction tend to be slightly more favorable with CAI.
- Students tend to have a positive attitude toward CAI frequently accompanied by increased motivation, attention span, and class attendance.
- CAI may increase labor productivity in the teaching/learning process. (Dalgaard et al., 1984, pp. 311-315)

The researchers stated that in order to obtain the current information about the costs of CAI, one must identify the input resources in terms of cost categories such as computer facility, communication system, software and courseware, operating costs. The findings were "that only six studies in the literature had devoted any systematic attention to examining the empirical basis of costs in CAI (p.315)." They concluded that there was a need for more studies of CAI in economic education that addressed the questions of cost feasibility and cost effectiveness.

Mulligan (1984) proposed a queuing model that could be used to ascertain the cost-function for computer-aided programmed instruction in economics. The purpose of the model was "to allow an administrator to determine the expected cost minimizing allocation of computer terminals and instructors, and to compare the merits of competing technology (p. 275)." The model made the following assumptions: (1) that the answering rate was a random Poisson variable, (2) That the steady-state time on task was an algebraic equation that was a function of terminals assigned, teachers assigned, the ratio of student per question to student progress, and (3) fixed prices for terminals and teachers. The researcher stated that "given the approximation for the algebraic equation and the fixed costs, the department administrator could determine the optimum cost-minimizing combination of terminals and instructors" (p. 278).

The review of the literature revealed a dissertation that used the pretest-posttest method to ascertain the effectiveness of CAI in the instruction of economics on the collegiate level. The research by Van Antwerp (1974) examined the impact of personality factors on the effectiveness of CAI and the lecture method in the presentation of economics to undergraduate students.

The sample for the Van Antwerp study consisted of seventy-two volunteer subjects. The pretesting consisted of a personality factor inventory, a test on economics, and a general inventory survey of the applicants' demographic characteristics and affinity towards computers. Next the subjects were classified into four categories of high and low levels of neuroticism and extraversion. Within each of these four levels the subjects were randomly assigned to treatments of CAI and lecture. After the treatment, a post-test was administered. The dependent variable was achievement gain. The independent variables were extraversion, neuroticism, and method of treatment. The major finding was that under the conditions of CAI and lecture, the personality factors of extraversion and neuroticism did not seem to interact with achievement. Van Antwerp suggested that the research appeared to support previous studies in which the CAI treatment group achieved better than those in the lecture group.

Miller and Weil (1986) studied the use of

interactive computer lessons for introductory economics at Wheaton College. The CAI they described was termed "guided inquiry" (p. 61) because it combined the strategy of posing problems for investigation with the interactive capabilities of the computer. The goal of the program was "to convert the student from a passive learner to an active one" (p. 62). The reported result of two years of utilizing interactive computer lessons in several introductory economics classes was an increase in the students' understanding of the most basic concepts in economics as reflected in their ability on tests.

Scherga (1986) proposed an alternate use of the microcomputer as a means of instruction: instruction through simulated programming (ISP). The research for ISP was conducted with the undergraduate students at Rutgers University. The underlying philosophy for ISP was based on the observation that in order to understand a concept one must be able to explain it to a student, and the observation that the economics instructor who programs a computer to teach economic concepts and to simulate an economic model is the one who really comprehends economics. He stated that:

Under ISP, the computer plays the role of the student, and the student plays the role of the teacher. Because the student teaches fundamental economic concepts to the computer, the student has the opportunity to develop her own intuition (p. 130).

The process of the implementation of ISP was

accomplished by first, having the instructor identify the sequential thought process that the student went through when writing the program; next, the instructor wrote the software that led the student through the thought process when the economic concepts were explained to the computer.

The difficulty with ISP arose from the limitations of computer programming languages. The computer coding was extremely lengthy and complex because the course instructor had to anticipate all possible responses, but the computer languages of BASIC, FORTRAN, COBOL, AND Pascal could be programmed to respond to a limited number of responses. The author called for future research to investigate the types of programs that can be written in artificial-intelligence languages.

#### Summary of the use of CAI in Economics Courses

A review of the literature of the use of computer aided instruction in the collegiate economics curriculum showed that the Test of Understanding in College Economics (TUCE) is a widely used instrument for CAI research because it has been nationally normed and due to the multiple pretest and posttest components of the TUCE. In the early 1970's CAI in economics instruction was viewed as more costly than similar methods of instruction due to the expensive cost of mainframe computers. The literature has suggested a need for current research in CAI in the dimensions of

microcomputer influence on achievement and in the cost-benefit analysis of CAI.

The researchers who reviewed the educational research literature found that the generalizations about the positive benefits of CAI in education have also been made for the discipline of economics. A review of relevant dissertations found that CAI provided positive gains in the achievement scores of college students. Additional findings included a number of new developments in the use of programming techniques in the instruction of economics.

#### Summary of the Review of the Literature

The purposes of this chapter have been to establish a conceptual framework for this dissertation and to acquaint the reader with the previous empirical studies that are relevant to this quasi-experimental study.

The review of the literature found that the conceptual framework of computer assisted instruction (CAI) consisted of the interaction between the various cognitive processes of the learner. Other findings included the cognitive assumptions of CAI, and the factors that impacted on the effectiveness of CAI.

This chapter reviewed national and regional CAI research in: (1) the field of education, (2) the college business departments, and (3) the discipline of economics. This review suggests several points that are relevant to this study: (1) the value of considering

quantitative and qualitative information about the subjects of the study, (2) the need for this study due to the scarcity of research in the utilization of microcomputers and economic CAI, and (3) the specific research methodology, survey and test instruments, and statistical analyses that have been used in previous economic doctoral dissertations that employed the pretest-posttest methodology.

## CHAPTER 3

### METHODS AND PROCEDURES

This chapter describes the research design of the study, population, sample selection procedures, instruments, materials, and procedures. Also provided in this chapter are the data analysis techniques used to answer the research questions.

#### Research Design

A variation of the nonequivalent control group design was selected as the most appropriate paradigm for the research methodology of this study. The design is a quasi-experimental research method that is frequently used in educational research, and involves:

an experimental group and a control group, both given a pretest and a posttest, but in which the control group and the experimental group do not have pre-experimental sampling equivalence. Rather the groups constitute naturally assembled collectives such as classrooms...the assignment of the treatment to one group or the other is assumed to be random and under the experimenter's control (Campbell & Stanley, 1963, p.47)

The selected variation of the design allows for one control group and the introduction of two forms of treatment i.e. computer aided instruction and supplemental reading. The specific design for this study consisted of the following:



		Supplemental Material		
		Pretest	Treatment	Posttest
CAI Experimental Group		T1	X	T2 Reading
Experimental Group	T1	X		T2 Control Group
T1	T2			

Issac and Michael (1985) stated that with the above design, conclusions can be reached about the differential effects of each supplemental treatment, "However, a more powerful conclusion can be made about both methods with a control group comparison" (p. 66).

#### Population

The population consisted of seventy students enrolled in the microeconomic classes of three baccalaureate institutions in the Piedmont region of North Carolina. Forty students were from Johnson C. Smith College in Charlotte, 15 students were from Barber-Scotia College in Concord, and 25 students were from Livingstone College in Salisbury.

#### Sample Selection Procedures

The students in the microeconomic classes at Johnson C. Smith University received the research treatment on the basis of their preassembled class groups. These groups consisted of 20 students in the microeconomics class that met on Tuesdays and Thursdays, this class received the supplemental computer aided instruction (CAI) for one hour a week. The 30 students in the Monday, Wednesday and Friday microeconomics class

received supplemental reading. Both classes were instructed by the same professor.

The students in the microeconomic class at Barber-Scotia College were randomly divided into two groups. One group received the CAI, the other received the supplemental reading.

The students in the microeconomic class at Livingstone College were selected to be the control group, consequently they did not receive any type of supplemental instruction.

Consent to participate in the study was obtained from the instructors and the business department chairmen at each academic institution (see Appendix A). Consent to participate in the study was not obtained from each student, however the students were informed about (1) the nature of the study, (2) the benefits to each student and academic institution, (3) the confidentiality of the collected data, and (4) the results of the study. The nature of the study was presented to the students by this researcher via the lecture method. This consisted of a diagram on the blackboard that explained the role of each school and each microeconomics class. The benefits of the study that were explained to the students included an increased familiarity with the subject matter, an acclimation to standardized economic tests, and an accumulation of data that might lead to the acquisition of more microcomputers. The students were assured that

their test results would remain confidential because they would not affix any type of identifying information such as names or students' identification numbers on the tests and only group descriptive statistical data such as means and standard deviations would be reported. The students were informed during a subsequent class period about the results of the study.

### Instruments

The instruments utilized in this research were: (1) Form A of the Microeconomics Test that is in the Revised Test of Understanding in College Economics (TUCE), published by the Joint Council on Economic Education in 1981 (pretest, see Appendix B); (2) Form B of the TUCE (posttest, see Appendix C); and (3) a modified version of the Brown University Student Questionnaire on Computers that was developed by the Institute for Research in Information and Scholarship under the direction of Dr. Mark Shields in 1983. The questionnaire was used to obtain data for the hypothesis that the variation in posttest scores can be explained at the .05 level of significance by prior economic courses, degree of computer literacy, socio-economic background, GPA, and prior typing courses (see Appendix D.).

"The reliability of an instrument refers to the consistency of its measurement" (Long, Convey & Chwalek, 1985, p.92.) Reliability can also be defined as: "The extent to which results obtained from a measure, or

series of related measures, produce consistent patterns of response in repeated measurement applications" (Shields, 1984, p. 17). The published technical reliability information regarding the TUCE indicates that Form B is slightly more difficult than Form A, whether used as either a pretest or posttest. The reported summary data about the pre and posttest concurrent validity of the microeconomics forms of the TUCE was established using two samples. A sample of 1,190 students were used for Form A and 984 students were used for Form B. The mean percentage correct, standard deviation, standard error of measurement, and Kuder-Richardson 20 for Form A were 41.7, 3.83, 2.52, and .57 respectively. The mean percentage correct, standard deviation, standard error of measurement, and Kuder-Richardson 20 for Form B were 40.4, 3.75, 2.47, and .56 respectively. Content validity was defined by Long et al. as an indication of "how well the material included in the instrument represents all possible material that could have been included" (1985, p. 90). The published content validity information regarding the TUCE states that:

the primary question regarding validity is whether the TUCE and the instruction offered to students are congruent. Congruence cannot be measured statistically; it is a matter of judgment by the instructor. A test that is properly related to a course of study is not a valid measure of achievement in that course. Before using the TUCE for evaluating students, instructors should analyze each test question in order to judge whether or not the test is valid for that particular course (Joint Council on Economic Education, 1981, p. 11).

The published validity information additionally states that:

"the standard error of measurement for posttest scores on the revised TUCE ranged from 2.44 to 2.51, which indicated that for approximately two-thirds of the scores obtained, the errors of measurement will be 2.51 or less. For about 95 percent of the scores obtained the errors of measurement will be two standard errors of measurement or less" (Joint Council on Economic Education, 1981 p. 11).

The published reliability information regarding the Brown University Student Questionnaire on Computers was obtained by utilizing the internal consistency method. This method produced a numerical estimate of reliability that was termed "Cronbach's Alpha Coefficient". The reported alphas were .80, .81, and .78, for students, faculty, and staff respectively (Shields, 1984, p. 18). The content validity was established via the expert judgment of researchers from the Brown University Institute for Research in Information and Scholarship, the Department of Sociology at Brown University, and the Massachusetts Institute of Technology (Shields, 1984, p. i).

#### Methods and Materials

The materials for the CAI consisted of IBM hardware and software. At Barber-Scotia College IBM PC-Junior microcomputers were used. Johnson C. Smith University used IBM personal computers.

The software used in this study was the IBM Pilot authoring language. This software was compatible with both the PC Jrs and the personal computers. The IBM

Pilot software was designed for teachers to write and present computer-aided instruction lessons with color, graphics, and sound. The software allowed the investigator: (1) decide how the instructional material was presented to the student; (2) give the student helpful guidance during the CAI when the student was having difficulty arriving at the correct response; and (3) decide how the students' response should be evaluated. The software possessed the capability to present summary data to the teacher about the name of the student and the number of tries for each question. However this capability was not used because of the need to keep the identification of the students confidential.

The methods were to offer structured supplemental reading as one form of treatment and drill and practice CAI as the other form of treatment. Both treatments addressed the same curriculum topics.

The CAI multiple choice questions for the module were constructed by the investigator and entered using the Pilot Software. The text of the question and the correct and incorrect alternatives were typed. The students were instructed to enter the letter corresponding to the correct answer. If the letter of the correct answer was entered the students saw the caption: "That's Correct" and the software was instructed to proceed to the next problem. For incorrect answers students received the message: " Try Again".

The supplemental reading for this study came from the text by Roger Miller (1982) Economics Today and the Teacher's Edition of the Wall Street Journal. A true and false quiz was given to the students to complete after they finished each supplemental reading. The answers to the quiz were in the reading assignments. The students in both the supplemental CAI groups and the supplemental reading groups were informed that some of the quiz questions (either the multiple choice CAI questions or the reading quiz questions) would appear on their midterm and final examinations.

#### Data Collection Procedures

First, the microeconomics pretest, which was Form A of the TUCE, was administered to the students at each of the three colleges during the early weeks of the Spring semester. During the next 6 weeks, supplemental reading material was given to both the CAI and reading treatment groups.

The content of the CAI and reading material covered the following categories:

<u>MODULE</u>	<u>Number of Lectures</u>	<u>Week#</u>	<u>CAI &amp; Reading #</u>
The Basic Economic Problem	2	1	1 Markets and
Price Mechanism 3	2-3 2		
Costs and Revenue	3	3-4	3 Profit
Maximization 3	4-6	4	
and Market Structure			

The supplemental reading for the first module focused on the concepts of opportunity costs and trade-offs. The reading was the article, "Does it Cost only \$3.34 a Day to Go to College" that was in the text by Miller Economics Today (1982, p. 15). The CAI group was asked multiple choice questions that also addressed the topics of opportunity costs trade-offs (see Appendix F). The objectives of the second module emphasized the concepts of supply, demand, elasticity, and resource allocation. The supplemental reading included a chapter summary by Miller, definitions of relevant terms, and study questions (see Appendix G). The CAI was composed of multiple choice questions concerning the topics of supply, demand, elasticity, and resource allocation (see Appendix H).

The learning objectives for the third module addressed indifference curves and practical applications of the theory of supply and demand. The supplemental reading and study questions (Miller, pp. 431-432) focused on analysing consumer choice with graphs, and shifts along the supply and demand curves (see Appendix I). The CAI questions focused on the same topics (see Appendix J).

The objectives of the last module of supplemental instruction emphasized marginal cost, variable cost, and equilibrium. The reading consisted of relevant terms, a chapter summary by Miller (pp. 480-482), and study questions (see Appendix K). The CAI questions were also



concerned with those subject areas (see Appendix L).

The pretest and posttest student scores were derived from the responses of the students to the sections of the TUCE that corresponded to the above curriculum topics. This assured congruence between the TUCE and the instruction offered to the students. The experiment concluded with the students completing the posttest, which was Form B of the TUCE, and the students completing the questionnaire which ascertained the students' exposure to prior economic courses, their degree of computer literacy, their family income, GPA, and typing acumen.

#### Data Analysis Techniques

The first research hypothesis was: "the students who did not receive any supplemental instruction (i.e. the control group) would score lower at the .05 level of significance than the students who received either CAI supplemental instruction or the students who read supplemental material in an undergraduate economics course" (i.e. the treatment groups). The pretest scores were used to assure group equivalence, i.e. that there were no significant differences between the control and treatment group means. In order to determine whether there was a significant difference at the .05 level between the means of the posttest scores of the control groups and the treatments groups, a t test was calculated. The t test is used:

to determine whether the observed difference between two variable means is likely to be a function of chance or not. A ratio is created by dividing the observed difference by the variation of differences that can be expected due to chance factors. This ratio is known as the t-ratio or the t-test for the significance of the difference between means. (Ary & Jacobs, 1976, p. 324)

The second research hypothesis was: "the students who received CAI would score higher at the .05 level of significance on the economics posttest than the students who read supplemental material". In order to determine whether there was a significant difference at the .05 level between the means of the posttest scores of the CAI groups and the means of the posttest scores of the supplemental reading groups, a t test was calculated.

The final research hypothesis was: "the the variation in posttest scores could be explained at the .05 level of significance by prior economic courses, degree of computer literacy, large family incomes, GPA, and prior typing courses". A multiple regression equation was constructed with posttest scores as the dependent variable. The independent variables consisted of the following survey instrument factors: prior economic courses, degree of computer literacy, family incomes, typing ability and current GPA. The purpose of the multiple regression equation was to determine the amount of variability of the dependent variable accounted for by each independent variable. The researcher used effect coding to regress the amount of variability that was accounted for by each of the survey

instrument factors. Effect coding is so named because:

the regression coefficients yielded by its use reflect the effects of the treatments of the analysis. The code numbers used are 1's, 0's, and -1's...different types of multiple comparisons can be easily performed by testing differences among regression coefficients obtained from effect coding. Consequently, effect coding is generally the preferred method of coding categorical variables. (Pedhazur, 1982, pp. 289-329)

#### Methodological Assumptions

The researcher analyzed the plots of the histograms and the plots of the residuals versus the predicted scores to ascertain that the key assumptions of regression analysis were not violated. These key assumptions included:

- 1) The assumption that a specificity error had not been committed, i.e. the linear equation model was not too simple.
- 2) The variance of the error terms was normally distributed (homoscedasticity). The frequency of the residuals was normal.
- 3) The independent variables were correlated with the dependent variable but not with each other.

#### Summary of the Methods and Procedures

The purposes of this chapter have been to describe the nonequivalent control group design that was selected as the paradigm for this study. This chapter informed the reader of the population, sample selection procedures, instruments, and materials that were utilized in this study. The chapter concluded with a description of the data analysis techniques that were used to address the research hypotheses and the methodological assumptions.

## CHAPTER IV

### ANALYSIS AND DISCUSSION OF THE FINDINGS

Data were collected in this study in order to investigate the effectiveness of supplemental computer aided instruction versus supplemental reading in the posttest achievement of students in microeconomic classes. In addition the study examined the contribution to the variation of the posttest scores that came from the students' previous economic courses, degree of computer literacy, GPA, socio-economic background, typing ability, and micro-economic teacher. This chapter will analyze and discuss the results of the study.

#### Data Analysis

##### Group Equivalency Analysis of Pretest Scores

The t-test comparison of the pretest scores revealed that there were no significant differences at the .05 level between the means of the control and treatment groups. Table 1 presents the results of the pretest for each group and the t-test comparisons. Table 1 contains the number of students in each group (n), the means (m), standard deviations (sd), degrees of freedom (df) comparison t-test statistic, and tabled t-test statistic (Glass & Hopkins, 1984, p. 530) that is significant at the .05 level.

Table 1

Results of the Pretest and t-test Comparisons

<u>Group</u>	<u>n</u>	<u>m</u>	<u>sd</u>	<u>df</u>	<u>t-test</u>	<u>Tabled t-test</u>
Control	19	25.4	11.3			
Barber-Scotia	8	29.4	13.7	11	.73	1.860
J. C. Smith CAI Group	12	23.5	14.4	19	-.38	1.782
J. C. Smith Reading	24	29.4	7.4	30	1.35	1.697

Test of Hypothesis 1

The first research hypothesis is:

The students who receive supplemental instruction will score higher on the TUCE posttest at the .05 level of significance than the students in the control group.

The data used as evidence to test the first research hypothesis were the TUCE posttest scores. The t-test technique was used to determine if the differences in the posttest scores were statistically significant.

The results of the one-tailed t-tests indicated that the differences in the means of the posttest scores of the control group and the students who received supplemental instruction were statistically significant at the .05 level. These results confirmed the first research hypothesis. Table 2 presents the results of the one-tailed t-test comparisons of the control group posttest scores and the means of the supplemental reading and supplemental CAI groups.

Table 2

Results of the Posttest and t-test Comparisons of  
the Control and Supplemental Instruction Groups

<u>Group</u>	<u>n</u>	<u>m</u>	<u>sd</u>	<u>df</u>	<u>t-test</u>	<u>Tabled t-test</u>
Control	18	23.7	8.7			
CAI Group	16	29.5	7.5	32	2.07*	1.650
Reading	31	30.5	12.9	42	1.71*	1.650

\* significant at the .05 level.

Additionally the data analysis included an analysis of the differences in the means of the control group and each supplemental instruction group at Barber-Scotia College and at Johnson C. Smith University. These results confirmed the research hypothesis for only the reading treatment group at Johnson C. Smith University. Table 3 presents the results of the posttest for each group and the t-test comparisons of the differences of the control group and the supplemental instruction groups. Table 3 shows the number of students in each group (n), the means (m), standard deviations (sd), degrees of freedom (df) comparison t-test statistic, and tabled t-test statistic (Glass & Hopkins, 1984, p. 530) that is significant at the .05 level.

Table 3

Results of the Posttest and t-test Comparisons of  
the Control and Supplemental Instruction Groups

<u>Group</u>	<u>n</u>	<u>m</u>	<u>sd</u>	<u>df</u>	<u>t-test</u>	<u>Tabled t-test</u>
Control	18	23.7	8.7			
J. C. Smith CAI Group	12	28.2	6.5	28	1.61	1.782
J. C. Smith Reading	26	32.5	13.3	42	2.63*	1.650
Barber-Scotia CAI Group	4	33.3	10.1	4	1.75	2.132
Barber-Scotia Reading	5	21.1	2.5	5	-1.14	2.015

\* significant at the .05 level.

Test of Hypothesis 2

The second research hypothesis is:

The students who receive CAI will score higher at the .05 level of significance on the microeconomics posttest than the students who read the supplemental material.

The data used as evidence to test the second research hypothesis were the TUCE posttest scores. The t-test technique was used to determine if the differences in the posttest scores of the CAI and supplemental reading groups were statistically significant.

The results of the one-tailed t-tests indicated that the differences in the means of the posttest scores of the CAI groups and the supplemental reading groups were not statistically significant at the .05 level. Therefore the second hypothesis was not confirmed. The

relationship of these findings to previously cited research will be explored in the discussion section of this study. Table 4 presents the results of the t-test comparisons of the CAI and reading groups at Johnson C. Smith University and at Barber-Scotia College. Additionally Table 4 presents the t-test comparisons of the combined CAI and Reading groups. Table 4 displays the number of students in each group (n), the means (m), standard deviations (sd), degrees of freedom (df) comparison t-test statistic, and the tabled t-test statistic (Glass & Hopkins, 1984, p. 530) that is significant at the .05 level.

Table 4

Results of the Posttest and t-test Comparisons of the CAI and Supplemental Instruction Groups

<u>Group</u>	<u>n</u>	<u>m</u>	<u>sd</u>	<u>df</u>	<u>t-test</u>	<u>Tabled t-test</u>
J. C. Smith CAI Group	12	28.2	6.5			
J. C. Smith Reading	26	32.5	13.3	36	-1.32	1.650
Barber-Scotia CAI Group	4	33.3	10.1			
Barber-Scotia Reading	5	21.1	2.5	4	2.01	2.132
Combined CAI Groups	16	29.5	7.5			
Combined CAI Reading Groups	31	30.6	12.9	44	-.38	1.650



### Test of Hypothesis 3

The third hypothesis is:

The variation in posttest scores will be explained at the .05 level of significance by prior economic courses, degree of computer literacy, family incomes, GPA, and typing ability.

The data used as evidence to test the third research hypothesis were the TUCE posttest scores and the students' answers to the questionnaire that ascertained the students' exposure to prior economic courses, degree of computer literacy, family income, GPA, and typing ability. Using the Statistical Package for the Social Sciences (SPSS) software, a multiple regression equation was constructed with effect coding to regress the amount of variability that was accounted for by each survey factor. The dependent variables was the posttest score. The independent variables were the survey instrument factors. An additional independent variable was the teacher of the microeconomic class. This variable was included in order to obtain statistical data that might explain the effect of the teacher on the variability of the posttest scores. The model for the multiple regression equation is  $Y = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10} + e$ . In the model "Y" is the posttest score, "a" is the value of the constant, the "B"'s are the coded effects of each independent variable. The variables in the equation are: X1 the CAI treatment, X2 the reading treatment, X3 is the number of prior

economic classes the student has taken, X4 is positive computer literacy, X5 is negative computer literacy, X6 is GPA, X7 is the amount of family income, X8 is the speed of typing ability, X9 is the J. C. Smith University teacher variable, X10 is the Barber-Scotia College teacher variable and "e" is the error term.

The results of the test of the third hypothesis yielded the following multiple regression equation:

$$Y = 7.83 + .88X1 + .14X2 + 4.56X3 + 1.40X4 \\ - 3.33X5 + .26X6 + .23X7 + .13X8 + 1.97X9 \\ -1.47X10.$$

The values for the terms that are not in the equation are: -1.02 for the control group, 2.04 for computer neutral and -.5 for the teacher effect at Livingstone College.

The coefficient of determination was the R-Square value of .19831. This indicated that approximately 20 percent of the variability in the posttest scores was explained by the set of chosen independent variables.

The standard error of the estimate was 10.06039. The error term is equal to 1 minus R-square which is a value of .80. This means that 88 percent of the variability of the posttest scores was not explained by the chosen set of independent variables. Possible reasons for this lack of explanation will be explored in the discussion section. Table 5 presents the results of the multiple regression analysis. None of the variables in the equation were statistically significant at the .05 level. Therefore, the third research hypothesis was not confirmed.

Table 5

Results of Multiple Regression Analysis

<u>Variable</u>	<u>b</u>	<u>Change in R-Square</u>	<u>Significance of F-Statistic</u>
(X1) CAI Treatment	.88	.00093	.7979
(X2) Reading Treatment	.14	.00000	1.0000
(X3) Prior Econ Classes	4.56	.02306	.2056
(X4) Favors Computers	1.40	.00185	.7182
(X5) Dislikes Comps.	- 3.33	.00284	.6550
(X6) GPA	.26	.02443	.1928
(X7) Family Income	.23	.02572	.1816
(X8) Typing Speed	.13	.00642	.5020
(X9) Teach Effect-JCSU	1.97	.00991	.4047
<u>(X10) Teach Effect-BSC</u>	<u>-1.47</u>	<u>.00260</u>	<u>.6686</u>
Computer Neutral	2.04	Multiple R	.44532
Control Group	-1.02	R Square	.19831
Teacher Effect- Liv.	-.50	Standard Error	10.06039

Additional FindingsPretest-posttest group comparisons.

The data used as evidence to compare the differences in pretest and posttest scores were the Forms A and B of the TUCE. A dependent t-test technique was used to determine if the differences in the pretest and posttest scores were statistically significant.

The results of the t-tests indicated that the differences in the means of the pretest and posttest scores of the groups were not statistically significant at the .05 level. Table 6 presents the results of the

pretest and posttest group comparisons. Table 6 displays the number of students in each group (n), the means (m), standard deviations (sd), degrees of freedom (df) comparison t-test statistic, and tabled t-test statistic (Glass & Hopkins, 1984, p. 530) that is significant at the .05 level.

Table 6

Results of the Pretest and Posttest Comparisons

<u>Group</u>	<u>n</u>	<u>m</u>	<u>sd</u>	<u>df</u>	<u>t-test</u>	<u>Tabled t-test</u>
Pretest Barber-Scotia	8	29.4	13.7			
Posttest Barber-Scotia	9	26.5	9.1	14	-.41	1.833
Pretest Livingstone (Control)	19	25.4	11.3			
Posttest Livingstone	18	23.7	8.7	34	-.02	-1.650
Pretest J. C. Smith Reading 42	24	29.4	7.3			
Posttest J. C. Smith Reading	26	32.5	13.3	40	.07	1.650
Pretest J. C. Smith CAI	12	23.5	14.4			
Posttest J. C. Smith CAI	12	28.2	6.4	22	.02	1.753

Results of the survey.

The responses to the survey revealed that 63 percent of the total sample ( $N=67$ ) of students have a positive attitude toward computers, 26 percent of the students are either ambivalent or have no strong feelings, and 10 percent of the students have never used a computer. Table 7 presents the control, CAI, and reading students' responses about their present experiences with computers.

Table 7

In general how would you describe your experience in using computers?

	Livingstone		J.C.Smith		BSC					
			CAI	Reading	CAI	Reading				
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>		
Positive	13	.63	8	.59	18	.69	2	.5	2	.40
Negative	0	.00	1	.08	0	.00	0	.0	0	.00
Ambivalent	1	.05	1	.08	3	.12	1	.25	1	.20
No Feelings	2	.10	3	.25	4	.15	1	.25	0	.00
Never Used	4	$\frac{.20}{100}$	0	$\frac{.00}{100}$	1	$\frac{.04}{100}$	0	$\frac{.0}{100}$	2	$\frac{.40}{100}$

The responses to the survey were that 90 percent of the total population ( $N=67$ ) were positive about using computers in the future and 10 percent possessed no strong feelings toward the future use of computers. The responses of the control, CAI, and reading groups are presented in Table 8.

Table 8

How would you describe your feelings about using computers in the future?

	Livingstone		J.C.Smith		BSC					
			CAI		Reading		CAI	Reading		
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>		
Positive	19	.90	12	100	25	.96	4	.80	4	.80
Negative	0	.00	0	.00	0	.00	0	.0	0	.00
Ambivalent	0	.00	0	.00	0	.00	0	.0	0	.00
No Feelings	2	.10	0	.00	1	.04	1	.20	0	.00
No Expectation	0	.00	0	.00	0	.00	0	.00	0	.00
		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>

The survey found that 88 percent of the total sample of students would rather use a computer more often than he or she does now. Table 9 presents the preferred frequency of computer use of the sample groups.

Table 9

Would you rather use a computer more or less often than you do now?

	Livingstone		J.C.Smith		BSC					
			CAI		Reading		CAI	Reading		
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>		
MORE OFTEN	17	.85	11	.92	23	.88	4	100	4	.80
LESS OFTEN	2	.10	0	.00	0	.00	0	.0	0	.00
NO CHANGE	1	.05	1	.08	3	.12	0	.0	1	.20
		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>

The findings from the survey regarding the grade point averages (GPA) of the respondents were that none had a GPA of less than 2.0, 48 percent were in the range of 2.0 to 2.50, 20 percent were in the range of 2.51 to 3.0, 26 percent were in the range of 3.01 to 3.5, and 6 percent had a GPA higher than 3.5. The GPA's of the sample groups are reported in table 10.

Table 10

What is your GPA?

	Livingstone		J.C.Smith		BSC					
			CAI		Reading		CAI		Reading	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Under 2.0	0	.00	0	.00	0	.00	0	.00	0	.00
2.0 to 2.50	12	.60	5	.42	11	.42	0	.00	3	.60
2.51 to 3.00	2	.10	3	.25	7	.27	2	.50	1	.20
3.01 to 3.50	6	.30	3	.25	5	.19	2	.50	1	.20
Above 3.5	0	.00	1	.08	3	.12	0	.00	0	.00
		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>

The findings from the survey that pertained to family income were that 15 percent of the total population had incomes of less than \$10,000, 28 percent were in the range of \$10,001 to \$20,000, 34 percent were in the range of \$20,001 to \$30,000, and 23 percent had family incomes greater than \$30,000. Table 11 presents the family income of the sample groups.

Table 11

What was your family's income for 1986?

	Livingstone		J.C.Smith		BSC					
			CAI		Reading		CAI		Reading	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
Under \$10,000	3	.15	1	.08	5	.19	0	.0	1	.20
10,001-20,000	3	.15	5	.42	7	.27	2	.50	1	.20
20,001-30,000	9	.45	6	.50	4	.15	1	.25	2	.40
Over \$30,000	3	<u>.15</u>	3	<u>.25</u>	10	<u>.39</u>	1	<u>.25</u>	1	<u>.20</u>
		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>		<u>100</u>

### Discussion

#### Hypothesis 1

The results of the t-tests pertaining to the first research hypothesis indicated that the differences in the means of the posttest scores of the control group and the supplemental instruction groups were statistically significant at the .05 level. An explanation for these results could be the extra amount of time that was spent studying the posttest topics in both the CAI and reading treatment groups. An alternative explanation could be the teacher effect. It is possible that the teacher at Livingstone was not as effective or as enthusiastic as the other two teachers in terms of the TUCE content. Table 3 indicates that the Reading group at J.C. Smith is contributing a substantial portion of the difference in group means.



## Hypothesis 2

The results of the t-test for the second research hypothesis indicated that the differences in the means of the posttest scores of the CAI groups and the supplemental reading groups were not statistically significant at the .05 level. Several possible explanations for these results are: 1) the researcher and the classroom teachers made an extra effort to incorporate economic concepts in the supplementary instruction instead of posttest questions, it was felt that this would enhance the students' overall comprehension of economics instead of "teaching the test"; 2) the CAI group students did not spend enough time interacting with the the computer due to the locking of the computer room at nights and on weekends at JCSU, the competition from other students in other JCSU classes for spreadsheet and word processing homework, the limited amount of computers at both campuses, and the locking of the computer room at Barber-Scotia College (BSC) at all times unless an instructor was present; 3) the instructors may have spent class time discussing other economic topics instead of the topics that were in the TUCE tests especially the concepts of insider trading and mergers because of the prominent press coverage that these topics received during the time period of this study; 4) the above average winter snowfalls in the region forced the cancellation of school for several days, thus

decreasing the number of class periods for the students; and 5) the students may have perceived the supplemental instruction as a low priority item because the researcher was not their instructor and therefore could not exercise any authority by demanding that they diligently study the supplemental material. These explanations also apply to the lack of pretest-posttest differences displayed in Table 6.

### Hypothesis 3

The set of variables that were chosen to confirm the third hypothesis were not successful. The reasons for the lack of failure of the treatment variables were explored above. The three variables that displayed an obvious trend towards statistical significance with a probability of less than .20 were the variables of GPA, prior economic classes, and family income. Possible explanations for this could be that 1) there is a logical relationship between GPA and test performance; 2) Table 5 documents the positive effect of the teacher at JCSU, although the effect was not statistically significant, this teacher may have made more of an impact on the performance of the students because of his enthusiasm about this study; and 3) the students from families with larger incomes may have been exposed to more economic learning experiences such as financial newspapers and family investments than the students from lower incomes. An explanation for the success of prior economic classes to explain the variability of the

posttest scores may be that the subject matter of the macroeconomic courses does apply to the microeconomics courses. The reason for the lack of success of typewriting ability may be due to the type of interaction between the student and the PILOT software, i.e. the student responded to the question by selecting the letter of the correct answer instead of typing in the answer. An explanation for the lack of success of the variable of computer literacy may be due to the fact that almost all of the students responded that they were computer literate. The relationship of the findings from the analysis of data to previously cited research included these three dimensions: 1) The theory of operant conditioning emphasized the rewards and punishments for good and bad behavior, in this study the researcher was not in an authoritative role therefore he could not influence the low test scores of the students by giving grades to the students based on their performances. 2) The research pertaining to the TUCE included the criticism that a multiple choice test cannot measure all of the objectives of instruction, this criticism may apply to the TUCE scores in this study because of their low test scores which minimized any statistically significant variations. 3) Although the CAI alone, did not produce statistically significant results, the trend was towards an improvement in test scores, this may confirm the beneficial effects of CAI that were previously cited.

### Pretest-posttest Comparisons

The results of the t-tests indicated that there were no significant differences between the pretest and posttest scores, although generally the absolute values of the posttests were higher than the values of the pretests thus indicating that some learning did take place. The possible explanations for those results are the same ones that this researcher gave for the results of the first and second hypotheses, especially the locking of the department computer rooms, the missed classes due to the inclement weather, the lack of congruence between actual class topics and the TUCE topics, the emphasis in the supplemental material on economic topics instead of the specific posttest questions, and the researchers' lack of authority. An alternative explanation could be that the TUCE did not measure the same curriculum topics that the instructors were emphasizing.

### Survey Findings

The survey findings revealed that the students have an enthusiastic outlook upon their present and future use of computers. The students were overwhelmingly in favor of more utilization of computers. The majority of the students have GPA's in the 2.0 to 3.0 range. The majority of the surveyed students have family incomes in the \$20,000 to \$30,000 range.

### Summary

The data analysis for the first research hypotheses confirmed the effectiveness of supplemental instruction in the chosen microeconomics classrooms. The second research hypothesis was not confirmed. There were several plausible explanations for the lack of success. The analysis of data revealed that there was a trend toward confirmation of the second research hypotheses. The relationships of the findings to previously cited research are that the findings appear to confirm the theory of operant conditioning and the benefits of CAI. The findings from the survey include that the students have a positive attitude towards computers and that the students would like more interaction with computers.

## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Chapter V contains a summary of the study, the conclusions derived from the findings, and the recommendations based on the conclusions.

#### Summary

The review of the literature found that technology has been linked to learning throughout most of the history of human civilization and that new approaches to learning are being stimulated by the growing availability of videodiscs, microcomputers, computer graphics, fiber optics, and lasers. Several studies revealed that many teachers agree that computers should be included in the curriculum because business students are expected to function in a world run, almost literally, by computers.

The literature search additionally found that although there have been numerous studies related to the use of technology in education, only a limited number have focused on the effectiveness of the microcomputer in economics instruction. Therefore, this study was designed to assess the effectiveness of computer assisted instruction (CAI) by comparing the impact of supplemental CAI to the impact of supplemental reading in College Economic Classrooms.

The major problem of the study was to assess the

effectiveness of CAI in the achievement of students in undergraduate microeconomics classes. The major impetus for the study was the need to utilize the scarce resources of faculty time and the microcomputers in the most effective and efficient manner. Additional needs for the study were due to the growth in the amount of computer utilization in the educational environment due to the reduction in the cost of microcomputers and from the demands of industry for computer literate college graduates.

A quasi-experimental pretest-posttest, non-equivalent control group design was used in the study. The nationally normed micro-economics pre and posttests from the Test of Understanding in College Economics were administered to the students at three four-year colleges. Three hypotheses dealing with differences in achievement among the groups based on type of instruction, previous economic courses, degree of computer literacy, keyboard familiarity, GPA, and socio-economic background were tested using the SPSSX multiple regression program.

The purpose of the study was to improve the effectiveness and efficiency of teaching at four year colleges by determining the practical outcomes of the investigation of the following research hypotheses:

- (1) The students who receive supplemental instruction will score higher on the TUCE posttest at the .05 level of significance than the students in the control group.

- (2) The students who receive CAI will score higher at the .05 level of significance on the TUCE posttest than the students who read the supplemental material.
- (3) The variation in posttest scores will be explained at the .05 level of significance by prior economic courses, computer literacy, family incomes, GPA, and typing ability.

The review of the literature for this study found that the cognitive processes of CAI are concerned with letting the learner acquire and reinforce subject matter at his or her own pace. Additionally, the cognitive assumptions of CAI include that previous instruction has taken place in a logical order. The implications of previous investigations into the cognitive processes of CAI revealed that interactive computer based systems must provide the opportunities for the learner to respond, make and correct errors, and observe the consequences of his or her actions. The characteristics of a good CAI system include both the design of the appropriate representations for learning and the inclusion of the necessary principles that support the acquisition of learning.

Past research revealed that CAI on the collegiate level has been found to be generally effective, as indicated on achievement examinations given at the end of instruction, however, most of this research took place prior to 1980. CAI has also been found to have been cost-effective to the degree that it could provide instruction more effectively than alternatives.



Additionally, this study found that the drill and practice programs were the most common form of software, and that the amount of educational software was growing rapidly. Other findings concluded that teachers reactions to computers were becoming more positive.

The review of the literature also revealed that the nation's graduate schools are rapidly incorporating CAI into their curricula. The literature suggested that CAI has had a positive impact on the performance of business students as measured on achievement tests. The findings also indicated that business educators on the collegiate level should have a working knowledge of the historical background of computer technology, the operating routines of a microcomputer, and hands-on experience with word-processing and spreadsheet software.

Other studies revealed that in the accounting discipline, CAI has significantly greater applications in schools that are accredited by the American Assembly of Collegiate Schools of Business (AACSB), and that computer utilization in AACSB member schools is expected to increase due to the demands of industry for computer literate managers.

The microcomputer was found to have been as effective as the mainframe in the instruction of BASIC. Additionally, the findings were that qualitative and quantitative measures should be used to assess the effectiveness of CAI.

The review of the literature of the use of computer aided instruction in the collegiate economics curriculum showed that the Test of Understanding in College Economics (TUCE) is a widely used instrument for CAI research because it has been nationally normed and due to the multiple forms which can be used for pretests and posttests. In the early 1970's CAI in economics instruction was viewed as more costly than similar methods of instruction due to the expensive cost of mainframe computers. The more current literature has suggested a need for additional research in CAI due to the growing evidence supporting the positive influence of CAI on achievement and the improved cost-benefit ratio of CAI.

The researchers who reviewed the educational research literature found that the generalizations about the positive benefits of CAI in education have also been made for the discipline of economics. A review of relevant dissertations found that CAI provided positive gains in the achievement scores of college students. Additional findings included a number of new developments in the use of programming techniques in the instruction of economics.

A variation of the nonequivalent control group design was selected as the most appropriate paradigm for the research methodology of this study. The design was a quasi-experimental research method that is frequently used in educational research.

The selected variation of the design allowed for one control group and the introduction of two forms of treatment i.e. computer aided instruction and supplemental reading. The population consisted of 70 students enrolled in the microeconomic classes of three baccalaureate institutions in the Piedmont region of North Carolina. Forty students were from Johnson C. Smith College in Charlotte, 15 students were from Barber-Scotia College in Concord, and 25 students were from Livingstone College in Salisbury.

The students in the microeconomic classes at Johnson C. Smith University received the research treatment on the basis of their preassembled class groups. The students in the microeconomic class at Barber-Scotia College were randomly divided into two groups. One group received the CAI, the other received the supplemental reading. The students in the microeconomic class at Livingstone College were selected to be the control group, consequently they did not receive any type of supplemental instruction.

The instruments utilized in this research were: (1) Form A of the Microeconomics Test that is in the Revised Test of Understanding in College Economics (TUCE), published by the Joint Council on Economic Education in 1981); (2) Form B of the TUCE; and (3) a modified version of the Brown University Student Questionnaire on Computers that was developed by the Institute for

Research in Information and Scholarship. The questionnaire was used to obtain data for the hypothesis that the variation in posttest scores can be explained at the .05 level of significance by prior economic courses, degree of computer literacy, socio-economic background, GPA, and prior typing courses.

The materials for the CAI consisted of IBM hardware and software. At Barber-Scotia College IBM PC-Junior microcomputers were used. Johnson C. Smith University used IBM personal computers. The software used in this study was the IBM Pilot authoring language. This software was compatible with both the PC Jrs and the personal computers. The IBM Pilot software was designed for teachers to write and present computer-aided instruction lessons with color, graphics, and sound. The software allowed the investigator to: (1) decide how the instructional material was presented to the student; (2) give the student helpful guidance during the CAI when the student was having difficulty arriving at the correct response; and (3) decide how the students' response should be evaluated. The CAI multiple choice questions for the module were constructed by the investigator and entered using the Pilot Software. The text of the question and the correct and incorrect alternatives were typed. The students were instructed to enter the letter corresponding to the correct answer. The supplemental reading for this study came from

the text by Roger Miller (1982) Economics Today and the Teacher's Edition of the Wall Street Journal. A true and false quiz was given to the students to complete, after they finished each supplemental reading. The answers to the quiz were in the reading assignments.

The data collection procedures consisted of first, the microeconomics pretest, Form A of the TUCE, which was administered to the students at each of the three colleges during the early weeks of the Spring semester. During the next six weeks, supplemental reading materials were given to both the CAI and reading treatment groups. The experiment concluded with the students completing the posttest, Form B of the TUCE, and the questionnaire which ascertained the students' exposure to prior economic courses, their degree of computer literacy, their family income, GPA, and typing acumen.

The first phase of the analysis of data consisted of a t-test of the pretest scores to assure group equivalence, i.e. that there was no significant difference between the control and treatment group means. The data analysis for the first hypothesis consisted of the calculation of a t-test in order to determine whether there was a significant difference at the .05 level between the means of the posttest scores of the control groups and the treatments groups. The second hypothesis was tested with a t-test in order

to determine whether there was a significant difference at the .05 level between the means of the posttest scores of the CAI groups and the means of the posttest scores of the supplemental reading groups.

The final research hypothesis was tested by constructing a multiple regression equation with posttest scores as the dependent variable. The independent variables consisted of the following survey instrument factors: prior economic courses, degree of computer literacy, family incomes, typing ability and current GPA. The purpose of the multiple regression equation was to determine the amount of variability of the dependent variable accounted for by each independent variable. The researcher used effect coding to indicate group membership. The researcher analyzed the plots of the histograms and the plots of the residuals versus the predicted scores to ascertain that the key assumptions of regression analysis were not violated.

The analysis of data confirmed the first research hypothesis. The second and third research hypotheses were not confirmed. The survey instrument revealed that the majority of the students in the study have a positive attitude toward computers, and that they would like to use computers more than they are presently using them.

Additional findings were that the majority of the students' GPA were in the 2.0 to 3.0 range and that the majority of the students' family income was in the range of \$20,000 to \$30,000.

### Conclusions

Based on the findings of this study, the conclusions are:

1) The use of supplemental reading and CAI instruction can enhance the achievement of students in microeconomic classes as measured by their performance on the TUCE Form B.

2) Since CAI was not shown to be more effective than supplemental reading, the degree of effectiveness of CAI versus reading could depend on the amount of time spent on task, the attitude of the teacher, the congruence of the supplemental material to the posttest, and the availability of the scarce resource of computer time.

3) The independent variables that made the greatest contribution to the explanation of posttest scores of microeconomic students were GPA, family income and number of prior economic classes.

4) Microeconomic students are positive about their present and future interactions with computers.

5) Microeconomic students would like to spend more time interacting with computers than they are presently spending.

### Recommendations

The results of this study of computer-aided instruction should and will be made available to the business instructors and department chairmen who contributed to this research. Due to the methods used and the obtained results of this study the following Institutional and Future Research Study recommendations should be considered:

#### Institutional

- 1) The business computer laboratories should be staffed in order for the students to have more access time to the hardware and software.
- 2) More computers should be purchased for each of the campuses in this study to satisfy the demand of both industry for computer literate graduates and the demand of the students for more computers.

#### Future Research Studies

- 3) Because of the limitations of only one form of CAI, it is recommended that future studies include several treatment groups. This could lead to the introduction of treatments that are tailored to the posttest that could be compared to treatments that are tailored to curriculum concepts.
- 4) In future studies the identity of the students should be affixed to the pretest and the posttest. This will allow the researcher to



identify the students who have made the most progress. This could help in the analysis of how individual learning styles are affected by the types of supplemental instruction.

- 5) Larger samples should be used to study the effectiveness of CAI. It is possible that with larger samples a more precise measurement of individual variables may be obtained thus leading to the confirmation of statistically significant relationships.
- 6) More independent variables should be added to the multiple regression equation for the purpose of explaining the variability of the posttest scores. Additional variables could include home variables such as financial investments by the family, and financial magazines and newspapers that the family receives. Additional life-style variables could include career plans and financial goals. Additional intelligence variables could include SAT scores and high school scores.
- 7) Future researchers could use a longer time period, and they could consider a different test than the TUCE.
- 8) The study should be repeated over a period of several years in order to explore trends and time series analysis of the effects of CAI.

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APPENDIX A  
CONSENT FORMS FROM THE MICROECONOMIC INSTRUCTORS AND  
DEPARTMENT HEADS



TO: WHOM IT MAY CONCERN

FROM: MR. J. RAO, PROFESSOR OF ECONOMICS &  
DR. S. PURI, CHAIRMAN OF THE DEPARTMENT  
OF BUSINESS ADMINISTRATION AT BARBER-SCOTIA COLLEGE

DATE: DECEMBER 12, 1986

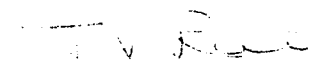
SUBJECT: THE DISSERTATION OF MR. RICHARD ELLIS

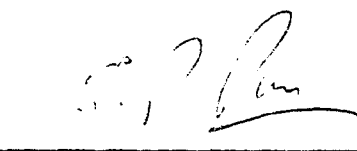
This memo confirms our willingness to allow Mr. Ellis to: 1) administer a limited response survey that ascertains prior economic classes, degree of student computer literacy, typing skills, family income, and GPA; 2) administer a pretest and post-test of economics to our students in the introductory economics class and 3) offer supplemental computer-aided instruction and supplemental reading instruction to the students in the Winter, 1986-87 semester microeconomics classes.

We understand that the tests will come from the Revised Test of Understanding in College Economics that was published in 1981 by the Joint Council on Economic Education.

The survey and the pretest will be administered during the first week of classes in January, 1987. The supplemental instruction will take place during the months of January and February in 1987. The post-test will be administered during February, 1987.

Sincerely

  
\_\_\_\_\_  
Mr. J. Rao

 12/14/86  
\_\_\_\_\_  
Dr. S. Puri

TO: WHOM IT MAY CONCERN

FROM: MR. WILLIAM MITCHELL, INSTRUCTOR OF ECONMICS &  
DR. BRION, CHAIRMAN OF THE DEPARTMENT OF BUSINESS  
ADMINISTRATION AT LIVINGSTONE COLLEGE

DATE: DECEMBER 10, 1986

SUBJECT: THE DISSERTATION OF MR. RICHARD ELLIS

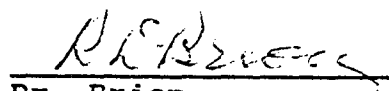
This memo confirms our willingness to allow Mr. Ellis to administer a limited response survey that ascertains prior economic classes, degree of student computer literacy, typing skills, family income, and GPA; and a pretest and post-test of economics to our students in the introductory economics class.

We understand that the tests will come from the Revised Test of Understanding in College Economics that was published in 1981 by the Joint Council on Economic Education.

The pretest will be administered during the first week of classes in January, 1987. The post-test will be administered during February 1987.

Sincerely

  
William B. Mitchell

  
Dr. Brion

TO: WHOM IT MAY CONCERN

FROM: MR. NICHOLAS DESAI, PROFESSOR OF ECONOMICS &  
DR. CHARLES ONWUCHEKWA, CHAIRMAN OF THE DEPARTMENT  
OF BUSINESS ADMINISTRATION AT JOHNSON C. SMITH  
COLLEGE

DATE: DECEMBER 12, 1986


SUBJECT: THE DISSERTATION OF MR. RICHARD ELLIS

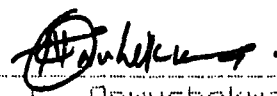
This memo confirms our willingness to allow Mr. Ellis to: 1) administer a limited response survey that ascertains prior economic classes, degree of student computer literacy, typing skills, family income, and GPA; 2) administer a pretest and post-test of economics to our students in the introductory economics class and 3) offer supplemental computer-aided instruction and supplemental reading instruction to the students in the Winter, 1986-87 semester microeconomics classes.

We understand that the tests will come from the Revised Test of Understanding in College Economics that was published in 1981 by the Joint Council on Economic Education.

The survey and the pretest will be administered during the first week of classes in January, 1987. The supplemental instruction will take place during the months of January and February in 1987. The post-test will be administered during February 1987.

Sincerely

  
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Mr. Nicholas Desai

  
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Dr. C. Onwuchekwa

APPENDIX B  
TUCE MICROECONOMICS FORM A (PRETEST)

## MICRO FORM A

1. Which of the following questions provides the best analogy to the basic economizing problem confronting any nation?
- A. Shall cars or tractors be produced in a given plant?
  - B. How can the number of cars produced in a given plant be increased?
  - C. What are the steel requirements for producing a specific type of tractor?
  - D. How many workers are required, on a particular assembly line, to produce 100 cars a week?

**QUESTIONS 2 AND 3 ARE BASED ON THE FOLLOWING INFORMATION:**

In an economy where there is unrestricted competition in all markets, coal is the primary source of heat for most households, and is produced in roughly equal amounts in all parts of the country. Suppose a supply of natural gas which can provide heat at a much lower cost is discovered.

2. What is the most likely effect of the natural gas discovery on the price of coal and the quantity of coal produced?
- | Price       | Quantity |
|-------------|----------|
| A. increase | decrease |
| B. decrease | decrease |
| C. increase | increase |
| D. decrease | increase |
3. Which of the following changes in the distribution of real income will most likely result from the natural gas discovery?
- I. The total real income of coal miners will fall relative to the average.
  - II. The total real income of residents in colder districts will rise relative to the average.
- A. I only
  - B. II only
  - C. both I and II
  - D. neither I nor II
4. How does the presence of a monopoly in an otherwise competitive full-employment economy tend to affect output of monopoly and competitive products?
- A. The output of both is too large.
  - B. The output of both is too small.
  - C. The output of the monopoly products is too large, and the output of the competitive products is too small.
  - D. The output of the monopoly products is too small, and the output of the competitive products is too large.

5. A student, in estimating the costs of her senior year at the university, proves her expertise as an economist by correctly including all the opportunity costs of her education. The items on her list include all but one of the following. Which one is NOT included:
- meals
  - tuition and fees
  - books and supplies
  - income from job given up
6. According to the U.S. Postmaster General, "Unless increased public funding enables us in the near term to slacken the pace of rate increases, we may be caught in a vicious cycle of rate increases to compensate for volume decreases brought on by rate increases." Which of the following is the most likely economic explanation of this situation?
- The "vicious cycle" is an insoluble problem because quantity demanded always falls with a rise in price.
  - There is no real "vicious cycle"; once the Post Office increases its rates enough, it will increase its revenues.
  - There is a "vicious cycle" because the Post Office is in the elastic portion of the demand curve; to increase revenue it should lower rates.
  - There is a "vicious cycle" because the Post Office is in the inelastic portion of the demand curve; to increase revenue it should lower rates.
7. Some people hold that our capacity to destroy the cities of any potential enemy is a necessary condition for keeping the peace, but that the capacity to do it three rather than two times over adds little or nothing to our national security. In economic terms, these people are saying that for America's deterrents:
- both the marginal and total utilities are low.
  - both the marginal and total utilities are high.
  - the marginal utility is high, although the total utility is low.
  - the marginal utility is low, although the total utility is high.
8. An example of "internalizing" and "externality" occurs when:
- a city government taxes a private firm for dumping waste into a public lake.
  - a city government subsidizes neighborhood improvements made by individual citizens.
- I only
  - II only
  - both I and II
  - neither I nor II
9. There has necessarily been a change in the market demand schedule of a commodity if:
- the production of the commodity has increased.
  - more of the commodity can be sold at the same price.
  - the commodity sells at a higher price than previously.
  - less of the commodity is being purchased than previously.
10. If a national system of free medical care for the aged poor is established, and the system is paid for by an increase in the income tax, these actions would promote one economic goal, but work against another. Specifically, these actions would be most likely to:
- promote equality but reduce freedom.
  - promote growth but reduce stability.
  - promote efficiency but reduce equality.
  - promote efficiency but reduce security.

11. If a firm finds that its marginal revenue exceeds its marginal cost, the maximum profit rule requires the firm to:

- A. increase its output in both perfect and imperfect competition.
- B. decrease its output in both perfect and imperfect competition.
- C. increase its output in perfect, but not necessarily in imperfect, competition.
- D. increase its output in imperfect, but not necessarily in perfect, competition.

12. In 1968, a man worked as a civil engineer for a construction firm at \$8,000 per year until he was drafted into the Army. His Army pay plus dependents allowance was \$4,000 per year.

Is \$8,000 or \$4,000 per year the better measure of the cost to society of the man's service in the Army in 1968? Why?

- A. \$4,000, because this is what he was paid for his Army service.
- B. \$8,000, because this would have been the value to society of his labors if he were not in the Army.
- C. \$4,000, because this was the amount of goods taxpayers had to give up to pay the taxes the government needed to pay him.
- D. \$8,000, because he paid less federal income tax while he was in the Army than he would have paid had he remained in civilian life.

13. The table below gives the number of tons of coal and steel that can be produced in Country A and Country B by using the same resource input (i.e., the same amount of labor, capital, and natural resources in both countries).

	Coal	Steel
Country A	10 tons	10 tons
Country B	8 tons	4 tons

If these were the only two countries and the only two commodities, and if these costs remain unchanged, Country B would find it advantageous to:

- A. import both coal and steel.
- B. export both coal and steel.
- C. import coal and export steel.
- D. export coal and import steel.

14. In a market economy, which of the following would determine how the factors of production are to be allocated?

- A. social custom
- B. the ways incomes are spent
- C. the exchange value of money
- D. the needs of the managerial class

15. "Deregulating the trucking industry is not the same as deregulating the airlines. Airlines have an expandable market—you lower rates and more people will travel. Trucking is different—if somebody has a thousand pieces to ship, he's not going to ship any more just because the rates are lowered."

Which of the following economic principles cast doubt on the part of the quotation dealing with the trucking industry?

- A. comparative advantage
- B. downward sloping demand
- C. increasing marginal cost
- D. price elasticity of supply

16. The Soviet constitution proclaims that no charge shall be made for use of water resources.
- This is efficient since water is a free good provided at no cost by nature.
  - This is inefficient whenever using water for one purpose prevents its use for another purpose.
  - This is an interesting difference from capitalism, but has no economic significance under socialism.
  - This will increase the satisfaction the Russian people can get from their limited resources since it will make goods like electricity and cotton, that are produced with water, cheaper.
17. In the early 1970s, the federal government proposed that new and stricter standards be established for sulphur dioxide emissions. Since burning coal produces large amounts of sulphur dioxide, these new standards would have especially affected coal burning firms. The president of the United Mine Workers protested the proposed standards on the grounds that they would "drive public utilities and other firms that burn large amounts of coal to nuclear reactors." This suggests that:
- coal was a cheap fuel partly because users could avoid some of the cost of burning it.
  - government intervention would have concealed the true economic advantages of cheap coal.
  - the sulphur dioxide standards, while well intended, were too strict to be economically practical.
  - miners would have preferred a tax on the use of coal rather than the sulphur dioxide standards.
18. If a firm faces a demand curve that slopes downward to the right, we can reasonably expect that:
- the firm must lower prices if it hopes to increase its profits.
  - the firm will have no effect on the price of the product it sells.
  - the firm will find that its marginal revenue is less than the price of the product it sells.
  - the firm will find that its marginal revenue is greater than the price of the product it sells.
19. Although statistical data show that broadcasting revenues exceed the profits of most professional sports teams, thus suggesting that these teams could not operate profitably without broadcasting revenues, an economist concluded that this overstates the importance of broadcasting for team owners' profits. How can the concept of economic rent be used to explain this conclusion?
- if there were no broadcasting, team owners would not have to rent TV lines, and their costs would be lower.
  - if the owners had to pay economic rent to players, they could never make a profit without broadcasting revenues.
  - if there were no broadcasting revenues, players' salaries would not include as much economic rent, and the team owners' costs would be lower.
  - without broadcasting, owners could operate as monopolies instead of competitors and collect enough economic rent to overcome the loss of TV revenue.

QUESTIONS 20 AND 21 ARE BASED ON THE FOLLOWING INFORMATION:

Smog in the Central City area is largely caused by automobile exhaust fumes. The smog problem could be virtually eliminated if approximately 100 air-purification plants were built in the area. These plants would simply draw in smog-filled air, remove the smog, and pump the clean air back into the Central City atmosphere. It is estimated that the cost of operating each plant would be \$10,000 per year.

20. It is highly unlikely that private business firms would build and operate the plants and sell their services directly to individual residents of the Central City area because:
- the cost of operating the plants would be too great.
  - so individuals would be willing to pay for smog-free air.
  - it would be less costly for the government to build and operate the plants than for private business firms to do so.
  - it would probably be impossible to provide smog-free air to those who are willing to pay for it while withholding it from those who refuse to pay.



21. Suppose that the government of Central City were to build and operate the air-purification plants. From the standpoint of achieving efficiency in the allocation of economic resources, which of the following taxes should be increased to provide the additional tax revenues needed to finance the operation of the air-purification plants?
- A. income
  - B. property
  - C. general sales
  - D. motor vehicle fuel
22. In June 1978, a driver who wished to buy gasoline and also have her car washed found that when she bought 11 gallons of gasoline at 88 cents per gallon, the car wash costs 75 cents, but that if she bought 12 gallons of gasoline, the car wash was free. For this driver, therefore, the marginal cost of the twelfth gallon of gasoline was:
- A. zero.
  - B. 13 cents.
  - C. 75 cents.
  - D. 88 cents.
23. Assume that the United Steel Workers succeed in raising wages in the steel industry. Under which of the following conditions, if any, will employment in the steel industry drop substantially (other things being equal)?
- A. Management increases prices, and the demand is inelastic.
  - B. Labor cost is a relatively small percentage of the final cost of steel.
  - C. There are few technical possibilities for substituting capital for labor.
  - D. None of the above is likely to cause a substantial decline of employment in the steel industry.
24. From the standpoint of economic efficiency, an unregulated private market system tends to:
- A. produce excessive amounts of public as distinct from private goods.
  - B. produce excessive amounts of goods which have substantial external costs.
  - C. produce excessive amounts of goods which have substantial external benefits.
  - D. produce the right amounts of goods and services without government intervention.
25. "A striking and for some reason almost unknown fact about the American Telephone and Telegraph Company is that its earnings have often gone up whenever the government has ordered its prices down." Below are listed four possible combinations of price elasticity of demand and marginal cost (relative to average cost) for telephone and telegraph services. Which of the four would, if true, best explain the "almost unknown fact" stated in the quotation?
- A. elastic demand, low marginal cost
  - B. inelastic demand, low marginal cost
  - C. elastic demand, high marginal cost
  - D. inelastic demand, high marginal cost
26. A family will be away from its house for six months. The monthly mortgage payment on the house is \$300. The local utility services, to be paid by the owner, and an allowance for "wear and tear" cost \$100 per month if the house is occupied; otherwise 0. If the family wishes to minimize its losses (or maximize its gains) on the house while it is away, it should rent for as much as the market will bear so long as monthly rent is above.
- A. \$ 0.
  - B. \$100.
  - C. \$300.
  - D. \$400.

27. In travelling about a city most people can use either a subway or a bus (they are substitutes). Suppose all subway fares were doubled, while bus fares remained unchanged. How would total fare revenue be affected by the subway fare increase?

Total fare revenue would:

- A. increase for both subways and buses.
  - B. decrease for both subways and buses.
  - C. increase for buses but might increase or decrease for subways.
  - D. increase for subways but might increase or decrease for buses.
28. "During the first year that the Salk vaccine for infantile paralysis became available, the quantity produced was too small to inoculate all those in susceptible age groups. Although the cost of production and the price were not particularly high, production could not be expanded rapidly enough to meet the quantity demanded. The government therefore intervened to regulate its distribution."
- What does the information in the quotation suggest about the price of Salk vaccine during the first year it was available?
- A. It was at equilibrium.
  - B. It was above equilibrium.
  - C. It was below equilibrium.
  - D. The relation to equilibrium cannot be determined from the information given.
29. "The bigger the volume, the lower the cost; that is the first law of all industry." Which of the following best describes this quotation?
- A. The quotation correctly states one of the laws of economics.
  - B. Although not a scientific law, the statement embodies a well-established generalization applying to most products, but not to all of them.
  - C. Although true for a limited number of products, the statement is not generally correct.
  - D. Although true up to a point for virtually all products, the statement is inconsistent with a well-established finding of economics.
30. In "tight" housing markets, rent controls are often enacted to hold the price of housing to a "reasonable" level. How does this policy affect the relative gains of tenants and landlords, and the allocative function of prices?
- A. It prevents landlords from gaining at the expense of tenants; the allocative function of prices is impaired.
  - B. It prevents landlords from gaining at the expense of tenants; the allocative function of prices is not impaired.
  - C. It prevents tenants from gaining at the expense of landlords; the allocative function of prices is impaired.
  - D. It prevents tenants from gaining at the expense of landlords; the allocative function of prices is not impaired.

APPENDIX C

TUCE MICROECONOMICS FORM B (POSTTEST)

## MICRO FORM B

1. Economic goods are termed scarce goods because they:
  - A. cannot be increased in quantity to any significant extent.
  - B. are of primary importance in satisfying the needs of a society.
  - C. are not available in sufficient quantities to satisfy all wants for them.
  - D. are not produced in sufficient quantities to satisfy the effective demand for them.
  
2. Other things constant, which, if any, of the following statements is correct?
  - I. If unemployment increases among those between ages 17 and 21, the opportunity cost of going to college decreases.
  - II. If men generally earn more than women in the labor market, the opportunity cost of attending college is higher for men than for women.
  - A. I only
  - B. II only
  - C. both I and II
  - D. neither I nor II
  
3. A conflict has arisen over the use of the Yat River between commercial fishermen, who have traditionally caught large quantities of salmon in the river, and a large producer of chemicals, who has begun to dispose of wastes by dumping them into the river. The large amount of wastes being dumped is killing a large number of fish. No other benefits (for instance, scenic) are derived from the river.
 

If the government wants to promote efficient resource use, which of the following policies would be most appropriate in this case? It should:

  - A. prohibit the chemical producer from dumping wastes into the river.
  - B. encourage fishermen to fish elsewhere and compensate them for any loss in income.
  - C. follow *laissez faire* principles, and let the free market's "invisible hand" determine river use.
  - D. allow the chemical producer to dump wastes into the river but charge the firm for the decrease in value of the river as a fishery.
  
4. "The effect of an excise tax on the products of pollution-producing industries will be a cutback in production. If the tax was levied directly on the amount of pollution generated, however, the long-run cutbacks in production would be much smaller." This statement is most likely to be:
  - A. false, because firms will leave the industry in the long run.
  - B. true, because taxes levied on pollution are easier to evade than taxes levied on products.
  - C. false, because most firms would rather pay the tax than cut back production.
  - D. true, because firms would have a greater incentive to adopt new technology that causes less pollution.
  
5. Other things constant, the law of diminishing marginal productivity (= diminishing returns) predicts that an increase in an economy's stock of capital would result in a **DECREASE** in:
  - A. wage rates.
  - B. the rate of interest.
  - C. labor's share of total income.
  - D. property owner's share of total income.

6. In describing the pricing policy for its retail stores, the J. C. Penney company has stated: "Merchandise was sold at the lowest prices possible, on the theory that many sales at low profit were better than few sales at high profit."

As described in this statement, J. C. Penney can be called a firm in:

- A. "imperfect competition" operating on the elastic portion of its demand curve.  
 B. "perfect competition" operating on the elastic portion of its demand curve.  
 C. "imperfect competition" operating on the inelastic portion of its demand curve.  
 D. "perfect competition" operating on the inelastic portion of its demand curve.
7. In New York, the city government regulates taxi fares. It also limits the number of taxicabs, and has not changed the limit for 40 years. At one time in the 1960s, vacant taxis were scarce and hard to find; but when the city increased the fares 25 percent, vacant taxis suddenly became plentiful. The result is BEST explained by the economic principle of:
- A. comparative advantage.  
 B. downward sloping demand.  
 C. increasing marginal cost.  
 D. diminishing marginal returns.
8. "If you live in a small city, get a good mechanical buy, pay cash, and don't drive very much, a car bought for \$1,800 will cost about \$2,880 if kept for one year:

Purchase price, including fees, taxes, etc. ....	\$1,800.
Insurance .....	250.
Gas and oil .....	500.
Routine maintenance .....	100.
License and registration .....	30.
Depreciation .....	200.
	<u>\$2,880.</u>

Which of the following is the best appraisal of this estimate of the yearly cost of an \$1,800 automobile?

- A. If the dollar amounts shown for each item listed are correct, the total gives a correct estimate of the yearly cost.  
 B. There is only one error—inclusion of the purchase price of the automobile.  
 C. There is only one error—omission of the interest that could have been obtained by lending the money spent on buying the car.  
 D. There are two errors—inclusion of the purchase price and omission of the interest foregone by buying the car.
9. A competitive firm's short-run supply curve is the same as:
- A. its marginal cost curve above average fixed cost.  
 B. its marginal cost curve above minimum marginal cost.  
 C. its average variable cost curve above the minimum point.  
 D. its marginal cost curve above minimum average variable cost.
10. If a national program of free housing for the aged poor is established, and the program is paid for by an increase in the income tax, these actions would promote one economic goal, but work against another. Specifically, these actions would be most likely to:
- A. promote equality but reduce freedom.  
 B. promote growth but reduce stability.  
 C. promote efficiency but reduce equality.  
 D. promote efficiency but reduce security.

11. By the end of 1970 the U.S. government had spent over \$700 million on the development of the SST (Supersonic Transport). The project was not complete, and the Nixon administration asked Congress for an additional appropriation of several hundred million dollars. In evaluating whether or not the additional appropriation should be made on purely economic grounds, one would recommend that Congress consider:
- the necessary additional costs to complete the project plus the government's past expenditures on the SST.
  - only the necessary additional costs to complete the project, ignoring the government's past expenditures on the SST.
  - the necessary additional costs to complete the project plus the interest payments incurred from making past expenditures on the SST.
  - the necessary additional costs to complete the project plus past expenditures on the SST, but given more weight to the additional costs.
12. If, at full employment, demand shifts toward the product of a capital-intensive industry and away from the product of a labor-intensive industry, which of the following is most likely to occur in the short run?
- Returns to both labor and owners of capital fall.
  - Returns to both labor and owners of capital increase.
  - Returns to owners of capital increase, returns to labor fall.
  - Returns to labor increase, returns to owners of capital fall.
13. "Nobody has to tell me why ticket prices for professional sporting events are so high. The owners cannot afford to take the loss of the high salaries, so they just pass it on to people like you and me." Is this statement most likely to be correct or incorrect? Why?
- Correct. High sports salaries force owners to charge high ticket prices, which they can pass on to consumers because demand is elastic.
  - Incorrect. The sports salaries contain "economic rent" and would not be so high if the public were unwilling to buy tickets at the high price.
  - Correct. High sports salaries contain "economic rent" and force owners to charge high ticket prices, which they can pass on to consumers since they are monopolies.
  - Incorrect. Owners can afford to pay the high salaries without raising ticket prices. They raise the price simply to increase their marginal revenue above their marginal cost.
14. Which of the following quotations is NOT an example of the "law of diminishing marginal utility"?
- "After a while, even TV gets boring."
  - "All work and no play makes Jack a dull boy."
  - "The second glass tastes just as good as the first."
  - "There's a limit to how much ice cream you want to eat in a day."
15. "The Environmental Protection Agency (EPA) issued a regulation requiring industries to remove toxic substances from the waste water they produce before it flows into city sewer systems. Previously, cities were responsible for toxic substance removal."
- Which of the following statement(s) describe(s) the most likely impact if all firms strictly adhere to the new EPA regulation on the treatment of toxic substances?
- By forcing the firms to internalize some negative externalities, the EPA is forcing the consumers of the firm's product to pay more for pollution prevention.
  - By forcing treatment of toxic substances before dumping wastes into the city sewer system, the EPA is reducing the general public's subsidy to the polluting firms.
- I only
  - II only
  - both I and II
  - neither I nor II

16. TVRama is considering a price reduction of 10 percent on its color TV sets, while prices for its black and white (B&W) TV sets are held constant. If most people regard color and black and white TV sets as reasonably close substitutes, what is the most likely effect of this price reduction on the firm's total revenues?
- Revenues from B&W sets will fall, while revenues from color sets would either increase or decrease.
  - Revenues from B&W sets will increase, while revenues from color sets would either increase or decrease.
  - Revenues from color sets will fall, while revenues from B&W sets would either increase or decrease.
  - Revenues from color sets will increase, while revenues from B&W sets would either increase or decrease.
17. Suppose a large city is investigating the elimination of rent controls on housing at a time when the vacancy rate is extremely low. Which of the following is most likely to occur if rent controls are eliminated?
- No change in rents, since price controls are usually set where supply and demand curves intersect.
  - A decrease in rents, followed by a decrease in the number of housing units supplied.
  - An increase in rents, followed by an increase in the number of housing units supplied.
  - An increase in the demand for housing, followed by a decrease in the number of housing units supplied.
18. The basic economic objection to unregulated, profit-maximizing monopoly is that:
- price will be above marginal cost.
  - price will not equal average cost.
  - marginal cost will not equal average cost.
  - marginal revenue will be below marginal cost.
19. What effect does widespread economic discrimination against women—excluding them from certain jobs and occupations where they would be as productive as men—have on total income earned by women, total income earned by men, and total national income?
- |    | Women's<br>Income | Men's<br>Income | Total<br>National<br>Income |
|----|-------------------|-----------------|-----------------------------|
| A. | Lower             | Higher          | Lower                       |
| B. | Lower             | Higher          | Higher                      |
| C. | Lower             | Higher          | No Difference               |
| D. | Lower             | No Difference   | Lower                       |
20. The engineering consulting firm of Fine and Point has recently announced the development of a more efficient procedure to convert gasoline-powered vehicles to solar-powered vehicles. The adoption of the Fine-Point technique will be speeded up by:
- the discovery and development of new oil deposits.
  - increased demand for petroleum products by the "developed" economies.
  - an increase in the volume of air pollutants which inhibit the rays of the sun from reaching earth.
  - a major reduction in the price of oil by the Organization of Petroleum-Exporting Countries (OPEC).
21. "As a result of recent high coffee prices, increased demand for tea has given tea producers an economic profit at the present time." If the tea industry is a perfectly competitive industry, and if sufficient time were allowed for adjustment to the increased demand, one would expect the tea industry's:
- output to increase, price to fall, and economic profit to disappear.
  - output to increase, price to fall, and economic profit to increase.
  - output to decrease, price to rise, and economic profit to increase.
  - output to decrease, price to rise, and economic profit to decrease.

22. "Deregulating the trucking industry is not the same as deregulating the airlines. Airlines have an expandable market—you lower rates and more people will travel. Trucking is different—if somebody has a thousand pieces to ship, he's not going to ship any more just because the rates are lowered."

What does this quotation imply about regulated trucking rates and the price elasticity of demand for trucking services?

Regulated Rates	Elasticity of Demand
A. below equilibrium	elastic
B. below equilibrium	inelastic
C. above equilibrium	elastic
D. above equilibrium	inelastic

23. The true cost to society of antipollution regulations is:
- the administrative cost of the programs.
  - the cost of cleaning up the environment now rather than at a later date.
  - the money spent on antipollution equipment minus any government subsidy.
  - the other things that could have been produced instead of reducing pollution.
24. If a firm must sell its product at the market price, whatever that price may be, and wants to earn as much profit as that price makes possible, it should:
- try to sell all the output it can produce, so its fixed cost per unit will keep falling.
  - never let marginal cost per unit reach equality with price, since this is the point at which profits become zero.
  - try to produce and sell that quantity of output at which marginal cost per unit has risen to equality with price.
  - try to produce and sell that quantity of output at which marginal cost per unit has reached its minimum-possible level.
25. Suppose a fully-employed economy had only two industries, one a pure monopoly the other perfectly competitive. Assuming that there are no economies of large-scale production, government antitrust action to break up the monopoly into many competitive firms would lead to:
- an increase in output for both industries.
  - a decrease in output for both industries.
  - an increase in output for the monopolized industry and a decrease in output for the competitive industry.
  - a decrease in output for the monopolized industry and an increase in output for the competitive industry.
26. The country that produces 50 percent of the world's coffee limits its coffee exports in order to increase its income from sales abroad. Which of the following conditions would contribute the most to the success of this policy?
- inelastic demand by coffee importers; inelastic supply by other coffee producers.
  - inelastic demand by coffee importers; elastic supply by other coffee producers.
  - elastic demand by coffee importers; inelastic supply by other coffee producers.
  - elastic demand by coffee importers; elastic supply by other coffee producers.



27. In how many of the following cases are "externalities" present?

- I. Private costs of production exceed social costs.
- II. Social costs of production exceed private costs.
- III. Private benefits of production exceed social benefits.
- IV. Social benefits of production exceed private benefits.

Externalities are present in:

- A. one case.
- B. two cases.
- C. three cases.
- D. four cases.

28. A state representative recently introduced a bill in the state legislature to increase the tax on beer sold within the state from \$.30 to \$.60 per gallon. He stated that his proposed tax would "tend to bring about more equality in the distribution of after-tax income within the state." His statement on the effect of the tax increase would be correct only if it could be shown that

- A. the quantity of beer purchased within the state is highly responsive to changes in its price.
- B. people with small incomes tend to buy more beer each year than people with larger incomes.
- C. people with large incomes tend to spend the same proportion of their income on beer each year as do people with smaller incomes.
- D. people with large incomes tend to spend a larger proportion of their incomes on beer each year than people with smaller incomes.

29. "Public goods" are generally provided by government rather than private enterprise because:

- I. the use of a public good by A reduces its usefulness to B.
- II. the benefits of public goods cannot be limited to the persons who pay for them.

- A. I only
- B. II only
- C. both I and II
- D. neither I nor II

30. "In private-enterprise economies, long-run prices must cover rent, interest, and labor cost of production plus a profit return to the enterprise owners. On the other hand, in completely socialized economies all natural resources and all capital goods are owned by the government, and all production takes place in government enterprises. Hence, in socialized economies labor costs are the only costs of production, and goods can be sold at lower prices than in private-enterprise economies. The lower prices of the socialized economies indicate that they are economically more efficient than private-enterprise economies."

Is the conclusion essentially correct or incorrect and why?

- A. Correct. The lower prices found in socialized economies indicate that the real incomes of households are larger than in private-enterprise economies. Therefore, the socialized economies are more efficient.
- B. Incorrect. The relative efficiency of different forms of economic organization depends on the allocation of all scarce resources—not on the prices assigned to resources.
- C. Correct. The lower prices found in socialized economies indicate that the real cost of production in socialized economies is less than in private-enterprise economies and that socialized economies are more efficient.
- D. Incorrect. The higher prices which are found in private-enterprise economies indicate that their output is more valuable than that of socialized economies. Therefore, private-enterprise economies are more efficient than socialized economies.

APPENDIX D  
QUESTIONNAIRE

### QUESTIONNAIRE ON COMPUTERS

Please answer the questions by CIRCLING the number of the response that best applies to you. (Answer even if you have not used a computer.)

1. In general, how would you describe your experience in using computers?
  1. POSITIVE
  2. NEGATIVE
  3. AMBIVALENT
  4. NO STRONG FEELINGS EITHER WAY
  5. HAVEN'T USED A COMPUTER
  
2. How would you describe your feelings about using computers in the future?
  1. POSITIVE
  2. NEGATIVE
  3. AMBIVALENT
  4. NO STRONG FEELINGS EITHER WAY
  5. DON'T EXPECT TO USE A COMPUTER

Circle one of the following responses for EACH of the questions below:  
 (1) YES, I have done this; (2) I haven't done this yet, but I EXPECT to do so in 1987; or (3) I haven't done this yet, and I have NO PLANS to do so in 1987.

Have You:	(1) YES	(2) EXPECT TO	(3) NO PLANS
3. Taken a computer science course?	1	2	3
4. Taken a course in department other than computer science in which you were required to use a computer?	1	2	3
5. Attended a non-credit "mini-course" on computing (e.g., CMS, XEDIT, SCRIPT, SAS, FOCUS, WORD-11, ETC.)?	1	2	3
6. Used a personal computer?	1	2	3

For each of the pairs of words below, circle a number to indicate which word of each pair comes closer to describing how YOU would generally characterize computers. Circle one of the following responses for each pair of words:

- (1) If you find the word on the LEFT a VERY APPROPRIATE description;
- (2) If the word on the LEFT is a SOMEWHAT APPROPRIATE description;

- (3) If NEITHER word is MORE APPROPRIATE than the other;
- (4) If the word on the RIGHT is a SOMEWHAT APPROPRIATE description; and
- (5) If the word on the RIGHT is a VERY APPROPRIATE description.

- |     |              |   |   |   |   |   |               |
|-----|--------------|---|---|---|---|---|---------------|
| 7.  | DIFFICULT    | 1 | 2 | 3 | 4 | 5 | EASY          |
| 8.  | FRIENDLY     | 1 | 2 | 3 | 4 | 5 | UNFRIENDLY    |
| 9.  | SMART        | 1 | 2 | 3 | 4 | 5 | DUMB          |
| 10. | RIGID        | 1 | 2 | 3 | 4 | 5 | FLEXIBLE      |
| 11. | EXCITING     | 1 | 2 | 3 | 4 | 5 | DULL          |
| 12. | INTIMIDATING | 1 | 2 | 3 | 4 | 5 | REASSURING    |
| 13. | FEMININE     | 1 | 2 | 3 | 4 | 5 | MASCULINE     |
| 14. | ROUTINE      | 1 | 2 | 3 | 4 | 5 | CREATIVE      |
| 15. | PREDICTABLE  | 1 | 2 | 3 | 4 | 5 | UNPREDICTABLE |
| 16. | ILLOGICAL    | 1 | 2 | 3 | 4 | 5 | LOGICAL       |
17. Would you rather use a computer MORE or LESS often than you do now?

- 1. MORE OFTEN
- 2. LESS OFTEN
- 3. NEITHER MORE NOR LESS OFTEN

18. On average, how many hours per week do you use a computer \_\_\_\_\_  
HOURS

19. What economic courses did you complete in high school?

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_

20. What economic courses have you completed in college completed?

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_

21. What is your GPA?

Under 2.0 \_\_\_\_ 2.0-2.50 \_\_\_\_ 2.51-3.00 \_\_\_\_  
3.01-3.5 \_\_\_\_ Above 3.5 \_\_\_\_

22. What was your family's income for 1985?

Under \$10,000 \_\_\_\_ \$10,001 to \$20,000 \_\_\_\_  
\$20,001 to \$30,000 \_\_\_\_ over \$30,000 \_\_\_\_

23. Have you previously taken a typewriting course?

Yes \_\_\_\_ No \_\_\_\_  
If yes, What is your wpm speed? \_\_\_\_

APPENDIX E  
STUDY QUESTIONS MODULE 1

## SUPPLEMENTAL READING

## THE BASIC ECONOMIC PROBLEM

Does It Cost Only \$3.34 a Day to Go to College?

True or False

- \_\_\_1. The cost-accounting for your education should include only your tuition room, board, and books.
- \_\_\_2. The cost of doing anything is its opportunity cost.
- \_\_\_3. Room, board and recreation represent a cost of going to school.
- \_\_\_4. The opportunity cost of going to school is measured by pre-tax income.
- \_\_\_5. A scholarship that pays your tuition reduces your opportunity cost.

APPENDIX F  
CAI QUESTIONS MODULE 1

## THE BASIC ECONOMIC PROBLEM

BY

Desai, Ellis, and Rao

W333

Q1. The economizing problem is essentially one of deciding how to make the best use of:

- A. limited resources to satisfy limited wants.
- B. unlimited resources to satisfy limited wants.
- C. limited resources to satisfy virtually unlimited wants.
- D. virtually unlimited resources to satisfy virtually unlimited wants.

Select A, B, C, or D

A.

B.

C.

D. That's Correct!

E1110

W110

Do Try Again!

In:ea

D.

F: This is the beginning of question 2

Q2.

Q2. The production possibilities curve illustrates the basic principle that

- A. an economy's capacity to produce increases in proportion to its population size.
- B. if all resources of an economy are in use more of one good can be produced only if less of another good is produced.
- C. an economy will automatically



seek that level of output at which  
all of its resources are employed.

The production of more of any  
one good will in time require  
smaller and smaller sacrifices  
of other goods.

Select A, B, C, or D

to:

as:

to:

m:b!B

ty:That's Correct!

ly:sp

w:10

tn: Try Again!

ju:ga

p:

r: This is the beginning of question 3

or:

24. Which of the following will

not entail an outward shift of the  
production possibilities curve?

A. the improvement of a society's  
technical knowledge.

B. an increase in the quantity  
of a society's labor force.

C. the reduction of employment

D. an upgrading of the quality  
of a nation's resources.

Select A, B, C, or D

to:

as:

to:

M:c!C

ty:That's Correct!

ly:sp

w:10

tn: Try Again!

jr:ja

r: This is the beginning of question 4

jr: The concept of economic efficiency is primarily concerned with:

A. the different institutions fostered by the various "isms".

B. the conservation of irreplaceable natural resources.

C. obtaining the maximum output from natural available resources.

D. considerations of equity in the distribution of wealth.

r: Select A,B,C, or D.

jr:  
jr:

r:

jr: C

r: That's Correct!

jr: 8p

w: 10

r: Try Again!

jr: ja

r:

r: This is the beginning of question 5

jr:

jr: 5. Money is not considered to be an economic resource because:

A. money is not a free gift of nature.

B. the terms of trade can be determined in nonmonetary terms.

C. idle money balances do not earn interest income.

D. money, as such, is not

C. idle money balances do not  
earn interest income.

The money, as such, is not  
productive.

Select A, B, C, or D.

As

is

ty That's Correct!

ly:ep

w:10

tn: Try Again!

jn:ga

P:

APPENDIX G  
STUDY QUESTIONS MODULE 2

## SUPPLEMENTAL READING

## MARKETS AND THE PRICE MECHANISM

## ELASTICITY &amp; INELASTICITY OF SUPPLY AND DEMAND

## True or False

- \_\_\_1. Elasticity of demand is defined as the percentage change in quantity supplied divided by the percentage change in price.
- \_\_\_2. Price elasticity of demand falls as we move down a straight line demand curve.
- \_\_\_3. Price elasticity of supply is the responsiveness of quantity demanded of a commodity to a change in its price.
- \_\_\_4. A vertical demand curve is perfectly inelastic.
- \_\_\_5. A horizontal demand curve is perfectly inelastic.
- \_\_\_6. Unitary elasticity of demand is the point where a decrease in price leads to no change in total revenue.
- \_\_\_7. The longer the time allowed for adjustment, the greater the price elasticity of demand.

APPENDIX H  
CAI QUESTIONS MODULE 2

Markets and the Price Mechanism

BY

By: Rao, Desai, and Ellis

W:15

T:

T:1. Suppose a large supply of natural gas is discovered.

: What is the most likely effect of the natural gas discovery on the price of coal and the quantity of coal produced?

	Price	Quantity
A.	increase	decrease
B.	decrease	decrease
C.	increase	increase
D.	decrease	increase

: Select A, B, C, or D.

T:

BY:

T:

W:15

T: That's Correct!

JY: 8p

W:10

T: Try again!

JN: 8a

T:

T: This is the beginning of question 2

P:

T: 2. There has necessarily been

a change in the market demand

schedule of a commodity if:

- : A. Its production has increased.
- : B. More can be sold at a higher price.
- : C. It sells at a higher price.
- : D. Less of it is being purchased.

T:

ty:That's Correct!  
jy:ep  
wj:10  
tn:Try again!  
jn:fa  
P:  
P:This is the beginning of question 3  
P:  
tx:  
t:3. In a market economy, which of  
the following would determine how  
factors of production are to  
be allocated.  
:  
:A. social custom  
:B. The ways incomes are spent  
:C. the exchange value of money.  
:D. the needs of the managerial class.  
  
Select A, B, C, or D.

ty:That's Correct!  
jy:ep  
wj:10  
tn:Try again!  
jn:fa  
P:  
P:This is the beginning of question 4  
P:  
t:4. In a city you can travel either  
by subway or by bus. If all subway fares  
were doubled, while bus fares did not change.  
:  
:Total fare revenue would:  
:  
:A. increase for both subways and buses  
:B. decrease for both subways and buses  
:C. increase for buses but might  
increase or decrease for subways.  
:D. increase for subways but might



increase or decrease for buses.  
Select A, B, C, or D.

Q:

A:

Q: That's Correct!

Q:

Q:

Q: Try again!

Q:

Q:

Q: This is the beginning of question 5

Q:

Q: 5. The equilibrium market basket is the one where a product's marginal utility is

A. lowest

B. median

C. highest

D. proportional to price if it is consumed.

Q: None of the above

Q: Select A, B, C, E, or D.

Q:

Q:

Q:

Q: That's Correct!

Q:

Q:

Q: Try again!

Q:

Q:

Q: This is the beginning of question 6

Q:

Q: 6. In general, the individual

demand curve will not remain

fixed if there is a change in:

A.

A. preferences

B. income

C. prices of other goods.

D. any of the above.

E. none of the above.

Select A, B, C, D, or E.

18

id:ID

ty:That's Correct!

ju:9p

w:10

tn:Try again!

jn:9a

p:

r:This is the beginning of question 7

p:

t:7.If the cross-elasticity of demand is negative,  
two commodities are:

:

:

- :A. complements
- :B. substitutes
- :C. positive elastomers
- :D. negative elastomers
- :E. None of the above

Select A, B, C, D, or E.

18

id:ID

ty:

m:a1A

ty:That's Correct!

ju:9p

w:10

tn:Try again!

jn:9a

p:

APPENDIX I  
STUDY QUESTIONS MODULE 3

## SUPPLEMENTAL READING

## COSTS AND REVENUE

## INDIFFERENCE CURVES

## True or False

- \_\_\_\_1. Indifference means that you are equally disposed to either of two alternatives.
- \_\_\_\_2. In exhibit D-1(a) the combinations A, B, C, and D represent varying combinations of beverages that do not give equal levels of satisfaction to the consumer.
- \_\_\_\_3. Each of the above combinations carries a different level of utility.
- \_\_\_\_4. The law of dimensioning marginal utility states that the more of something that someone has, the lower will be its utility.
- \_\_\_\_5. In mathematical jargon, an indifference curve is convex with respect to its origin.
- \_\_\_\_6. We can measure the marginal utility of something by the quantity of a substitute good that would leave the customer indifferent.

APPENDIX J  
CAI QUESTIONS MODULE 3

1 INDIFFERENCE CURVES  
2 SUPPLY AND DEMAND

3 BY

4 Desai, Ellis, and Rao

5 w:25

6 ID:

7 Q1. A product has utility if it:

- 8 A. is useful
- 9 B. satisfies consumer wants
- 10 C. violates the law of demand
- 11 D. none of the above

12 Select A,B,C, or D

13 to:

14 45:

15

16 b:15

17 ty: That's Correct!

18 jn:15

19 w:10

20 In Try Again!

21 jn:ea

22 D:

23 This is the beginning of question 2

24 p:

25 Q2. An indifference curve shows all:

- 26 A. possible combinations of two
- 27 products which a consumer can
- 28 purchase, given her income and
- 29 the prices of the products.
- 30 B. combinations of two products which
- 31 products which yield the same
- 32 total utility to a customer
- 33 C. equilibrium combinations of two
- 34 products which are obtainable with a
- 35 given money income.
- 36 D. possible equilibrium positions
- 37 on an indifference map.

Select A, B, C or D

as:  
m:b!B  
ty: That's Correct!  
jy:ep  
w:10  
tn:Try Again!  
jn:9a

r:This is the beginning of question 3

p:  
t:3. An indifference curve:

- A. is downsloping and has a constant slope.
- B. is downsloping and concave to the origin.
- C. is upsloping and has a constant slope.

D. is downsloping and convex to the origin.

Select A, B, C, or D

as:  
m:d!D  
ty: That's Correct!  
jy:ep  
w:10  
tn:Try Again!  
jn:9a

r:This is the beginning of question 4

p:  
t:4. A change in demand means:

- A. the quantity demanded changes as price changes.
- B. a movement along a given demand schedule or curve.

- C. the shift of a demand curve.
- D. a change in the elasticity of a demand curve.

Select A, B, C, or D.

:

as:

t:

ma: C

ty: That's Correct!

jy: @p

w: 10

tn: Try Again!

jn: @a

:

r: This is the beginning of question 5

p:

t: 5. In which of the following instances will total receipts decline?

- A. price rises and demand is elastic.
- B. price rises and demand is inelastic.

- C. price falls and demand is elastic.
- D. price rises and supply is elastic.

Select A, B, C, or D.

:

as:

t:

ma: A

ty: That's Correct!

jy: @p

w: 10

tn: Try Again!

jn: @a

p:

r: This is the beginning of question 6

p:

t: 6. An effective price support on wheat will:

- A. clear the market for wheat.
- B. result in a surplus of wheat.



.C. result in a shortage of wheat.  
.D. force otherwise profitable  
farmers out of business.

: Select A, B, C, or D.

as:

t:

m:b!B

ty: That's Correct!

jy:@p

w:10

tn:Try Again!

jn:@a

p:

r:This is the beginning of question 7

p:

t:7. An effective minimum wage law  
can be expected to:

.A. cause unemployment for some  
workers.

.B. increase employment for some  
workers.

.C. increase the number of firms  
in those industries wherein  
the law is effective.

.D. clear the market for  
blue-collar workers.

: Select A,B,C, or D.

t:

as:

t:

m:a!A

ty: That's Correct!

jy:@p

w:10

tn:Try Again!

jn:@a

p:

t:

as:

r  
n:  
ty: That's Correct!  
jy: @p  
w: 10  
tn: Try Again!  
jn: @  
p:  
r: This is the beginning of question 10  
p:  
t: 1  
:  
:  
t:  
as:  
t:  
m:

APPENDIX K  
STUDY QUESTIONS MODULE 4

## SUPPLEMENTAL READING

## PROFIT MAXIMIZATION AND MARKET STRUCTURE

## PERFECT COMPETITION, MARGINAL AND TOTAL REVENUES, BREAK-EVEN

## True or False

- \_\_\_1. In perfect competition a firm can affect the price of the product it sells.
- \_\_\_2. Marginal revenue is the price per unit times the total quantity sold.
- \_\_\_3. Total costs are all of the cost added together.
- \_\_\_4. In perfect competition the firm faces a completely elastic demand curve for its product.
- \_\_\_5. The firm maximizes profits where marginal cost equal marginal revenue.
- \_\_\_6. The break-even point is where a firms total revenue equals total costs.

APPENDIX L  
CAI QUESTIONS MODULE 4

PROFIT MAXIMIZATION AND MARKET  
STRUCTURE

BY

DESAI, ELLIS, & RAO

W:25

TX:

T:1. Marginal Cost may be defined as the:

- :A. change in average total cost which results from producing one more unit of output.
- :B. change in average variable cost which results from producing one more unit of output.
- :C. change in total cost which results from producing one more unit of output.
- :D. rate of change in total fixed cost which results from producing one more unit of output.

Select A,B,C, or D.

T

AS:

T:

M:OIC

TY: THAT'S CORRECT!

JY:EP

W:10

TN: TRY AGAIN!

JN:EA

P:

R:THIS IS THE BEGINNING OF QUESTION 2

P:

T:2. Which of the following statements applies to a purely competitive firm?

- :A. Its product is slightly different from its competitors.
- :B. Its product will have a brand name.
- :C. In long-run equilibrium it will

earn an economic profit.  
 D. It will not advertise its product.

Select A, B, C, or D.

T:

AS:

T:

M:c!D

TY: THAT'S CORRECT!

JY:@P

W:10

TN:TRY AGAIN!

JN:@A

P:

R:THIS IS THE BEGINNING OF QUESTION 3

P:

T:3. When a firm is maximizing profits  
 it will necessarily be:

- A. maximizing total revenue.
- B. minimizing total cost.

- C. maximizing the difference between  
 total revenue and total cost.
- D. maximizing profit per unit  
 of output.

Select A, B, C, or D.

T:

AS:

T:

M:c!C

TY: THAT'S CORRECT!

JY:@P

W:10

TN:TRY AGAIN!

JN:@A

P:

R:THIS IS THE BEGINNING OF QUESTION 4

P:

T:4. The demand curve confronted by the  
 individual purely competitive firm is:

- A. perfectly elastic

B. relatively inelastic, that is the  
elasticity coefficient is less than 1.  
C. perfectly elastic.  
D. relatively elastic, that is the  
elasticity coefficient is more than 1.

Select A, B, C, or D

T:

AS:

T:

M:c1C

TY: THAT'S CORRECT!

JY: @P

W: 10

TN: TRY AGAIN!

JN: @A

P:

R: THIS IS THE BEGINNING OF QUESTION 5

P:

T: 5. A competitive firm can determine the  
profit-maximizing output by equating:

A. price and marginal revenue  
B. marginal revenue and marginal cost  
C. price and average fixed cost.  
D. price and average total cost.

Select A, B, C, or D.

T:

AS:

T:

M:b1B

TY: THAT'S CORRECT!

JY: @P

W: 10

TN: TRY AGAIN!

JN: @A

P:

R: THIS IS THE BEGINNING OF QUESTION 6

P:

T: 6. If a firm finds that its marginal  
revenue exceeds its marginal cost, the



Maximum profit rule requires the firm to:

- A. Increase its output in both perfect and imperfect competition.
- B. Decrease its output in both perfect and imperfect competition.
- C. Increase its output in perfect, but not necessarily in imperfect competition.
- D. Increase its output in imperfect, but not necessarily in perfect, competition.

Select A,B,C, or D

T:  
AS:  
T:  
M:a!A  
TY: THAT'S CORRECT!  
TY:@P  
W:10  
TN: TRY AGAIN!  
JN:SA  
P:

- A. Increase its output in both perfect and imperfect competition.
- B. decrease its output in both perfect and imperfect competition.
- C. increase its output in perfect, but not necessarily in imperfect competition.
- D. increase its output in imperfect, but not necessarily in perfect, competition.

Select A,B,C, or D

T:  
AS:  
T:  
M:a!A  
TY: THAT'S CORRECT!  
TY:@P  
W:10  
TN: TRY AGAIN!  
JN:SA  
P: